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HORTICULTURAL ABSTRACTS

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HORTICULTURAL ABSTRACTS.

VOL. VII.

MARCH, 1937.

No. 1.

Abstracts. Initialled abstracts in this number are by M. H. Moore of the East Malling Research Station, P. K. Sen, Physiological Botanist, Imperial Council of Agricultural Research, India, and A. Voss, Exam. Trädgårdsmästare, Sweden.

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Horticultural Abstracts

Vol. VII

March, 1937

No. 1

HORTICULTURE—MISCELLANEOUS.

1. BOLLMANN, A. 546.27 : 543/5
 Die Bestimmung kleinster Bormengen. (**The determination of very small quantities of boron.**)
Forschungsdienst, 1936, 2 : 600-4, bibl. 56.

This is a summary, adequately documented, of the different methods of determining boron in soils and plants. The author divides the methods into 3 groups : (1) Direct or indirect analytical determination by weight. Most of these have been known for some time and are not suitable for very accurate determinations. (2) Titration methods, including the microtitration methods which are now used for the determination of boron in plant ash and soil. (3) Optical methods which also comprise technical devices, useful for fine determinations. Brief notes follow on the various ways in which individual workers have used the different methods, especially those classed in groups 2 and 3 above.

2. BERTRAND, G., AND DE WAAL, H. 581.192 : 546.27
 Recherches sur la teneur comparative en bore de plantes cultivées sur le même sol. (**Comparative boron content of plants grown in identical soils.**)
Ann. agron., Paris, 1936, 6 : 537-41, bibl. 8.

The boron content of a large number of crop plants growing side by side on identical soils was determined both by colorimetric and volumetric methods. The latter is very exact and the former sufficiently so. The difference in the boron fixing powers of the various plants is striking, ranging from 2.3 mg. per kg. of dry matter in the case of barley to 94.7 mg. in poppy.

3. SCHARRER, K., AND SCHROPP, W. 612.014.44 : 633.491-1.83
 Weitere Untersuchungen über die Wirkung des Kalium = Ions bei mangelnder Lichtversorgung. (**Further investigations on the action of the K ion on plant growth in the absence of sufficient light.**)
Ernähr. Pfl., 1936, 32 : 293-300, bibl. 3.

The authors first note briefly the results achieved by themselves in a previous experiment of a similar nature with peas and show how the addition of potash was of material assistance to pea plants deprived of a normally good light supply. They mention also the work of Gassner and Goeze on assimilation, chlorophyll and transpiration, which showed that in the presence of strong light K had no effect. Finally Schwarz has shown that the yield of seed in pasture grass can only be kept high under conditions of extreme shading by the addition of large amounts of K. The trials described here were made in pots with potato plants. The questions for which an answer was sought were (1) What is the effect of increasing applications of K on the yield and starch content of potatoes in the presence and absence of sufficient light ? (2) How is the chlorophyll content affected ? (3) What effect has different intensity of light during growth on the composition of the crop ? There were 8 treatments, namely NP, normal illumination but no K ; NP, normal illumination + 1.5 grams K_2O ; NP, normal illumination + 3.0 grams K_2O ; and NP, normal illumination + 4.5 grams K_2O ; and the above treatments repeated

but with shade conditions instead of normal illumination. In 1933 sulphate of potash and magnesia was used, in 1934 potassium chloride and sulphate of potash as sources of K. Results, which are given in detail, may be summarized thus:—Increasing applications of K tended to counteract the depressing effect of insufficient light. They also reduced the unfavourable effect of shading as regards the yield of crude protein. Chlorophyll was formed in greater amount in the shaded than in the unshaded plants and increased with increasing doses of K. Fresh weights of the haulms were in all cases greater in the shaded than in the unshaded plants.

4. CHOUARD, P. 612.014.44
 Chaleur, lumière et radiations. Principes de leur action sur les plantes.
 (Heat, light and forms of radiation. Principles governing their action on plants.)
C. R. Acad. Agric. Fr., 1936, 22 : 133-40.

Methods and effects of providing plants with various forms of artificial heat and light are summarized. Among heating methods, particular attention is paid to a new system involving the use of "panneaux radiants" (heat radiating panels). These consist of large surfaces, generally made of cement, which are heated in a mass when placed as walls around plants growing in the open air [see abst. 5—ED.]. In trials during the past two winters azaleas and cinerarias have flowered and strawberries and tomatoes have fruited at Paris without any other form of protection. Of the methods of providing artificial light two are considered theoretically to be of established worth, namely lighting at night by means of low-power incandescent lamps for hastening the flowering of long-day plants and, secondly, lighting at night by neon lamps for forcing growth in young plants. The latter is unfortunately too expensive at the present time. The effects exerted by different forms of light and other rays upon plants are briefly discussed.

5. ANON. (X). 612.014.44
 Le chauffage par panneaux rayonnants. (Heating by means of heat-radiating walls.)
Rev. hort. suisse, 1936, 9 : 266-74.

An account is given of the system of heating by means of heat-radiating walls evolved by M. Emile Bigeault of Paris, whereby plants may be induced to grow, flower and fruit normally in mid-winter in the open air. The system is based on a series of parallel walls consisting of a special type of concrete, and enclosing steel pipes, through which water that is warmed, but always below 50°C., is passed. The height and shape of the walls depend upon the type of plant to be grown, and the distance between them likewise varies from 40 to 130 cm. A number of photographs are included which show very clearly systems adapted for various crops. In the space between each pair of walls soil is placed over a second network of warm water pipes. The success of the method is considered to be due primarily to the unrestricted passage of infra-red and ultra-violet rays to the plants, and to the maintenance of even, though not particularly high, temperatures. Plant growth has been observed to continue between the walls at a time when outside 10 cm. of snow lay on the ground and the temperature was -11°C. Lilies of the valley, hyacinths, dahlias, azaleas, hydrangeas, tulips, camellias, etc. have flowered, and crops of strawberries, peaches, radishes, cabbages, potatoes and asparagus, etc. have been obtained in mid-winter at Saint-Agnan when grown in this way. Finally it may be of interest to add that in a footnote the author states that the system appears to be a modern version of the old Roman method of heating by means of hypocausts.

6. GAGER, C. S. 581.143 : 535.21
 The effects of radium rays on plants. A brief résumé of the more important papers from 1901 to 1932.
Contr. Brooklyn bot. Gdn., 74, 1936, pp. 27, bibl. 88, reprinted from *Biol. Effects of Radiation*, May 1936, pp. 987-1013.

The literature on the subject is reviewed clearly and concisely.

7. LEWIS, D. 631.85 : 635.52
A note on the absorption of solutes by leaves.
J. Pomol., 1937, 14 : 391.

The author notes an important piece of evidence with regard to the absorption of solutes by leaves which was forthcoming in certain unfinished work on the subject at Reading. Lettuce plants grown in soil in pots were sprayed daily for 5 weeks with an atomizer containing a dilute nutrient solution in which were potassium sulphate, potassium phosphate and sodium nitrate. Although no significant differences were found in the K or protein N content of the sprayed and control plants, a marked and significant increase in P was discovered in the sprayed plants, indicating that this element can be absorbed by lettuce leaves, at least when the soil in which they are growing is deficient in this element.

8. THOMAS, W. 581.192 : 631.84 + 631.85
Mathematical expression of equilibrium between nitrogen and phosphoric acid in plants.
Science, 1936, 84 : 422-3, bibl. 3.

Certain plots at the Pennsylvania State College, on which potatoes were growing in 1935, were examined, in the course of investigations concerning the influence of soil and weather on the action of fertilizers, by means of periodic analyses of leaves of the same diagnostic age (foliar diagnosis). The optimum physiological balance between nitrogen (N) and phosphoric acid (P_2O_5) for the soil and climatic conditions of the region was obtained from a plot receiving partly-rotted horse manure which consistently gave the highest yields. It is represented as a line drawn by joining the co-ordinates for two samplings of leaves of the same physiological age obtained from plants growing on the plot. Data obtained on 4 sampling dates by chemical analysis of total N and P_2O_5 in plants on three other plots receiving commercial fertilizers, namely N, P + K, and N + P + K, are plotted as ordinates and abscissae, respectively, on the same graph as the optimum line. The deviation from the optimum line with respect to position, form and length between sampling dates thus shows in each case the nature of the disequilibrium between N and P_2O_5 in the plants growing on each particular plot, and may be regarded as an indicator of the lack of physiological balance between N and P_2O_5 . Details are to be published elsewhere.

9. EATON, F. M. 581.084.1
Automatically operated sand-culture equipment.
J. agric. Res., 1936, 53 : 433-44, bibl. in text.

The improved automatically operated sand-culture equipment described herein is designed to provide (1) the advantages of large-vessel, or flowing-type, water cultures with regard to the maintenance of solution concentration, and (2) the numerous advantages of sand cultures, such as aeration, iron supply, seedling germination, root environment, and elimination of plant supports. The solution is applied by motor pumps controlled by a time clock to the surface of free-draining sand cultures at hourly or other selected intervals. The displaced solution returns by gravity to the supply reservoir. Equipment in use at the Rubidoux Laboratory is described, and suggestions are offered on the construction of sand beds and solution reservoirs, on types of sand, iron supply from water-insoluble minerals, control of troublesome organisms in the sand, and the applicability of the method to hothouse culture. A brief account of the composition of certain culture solutions is given for the convenience of those interested in the propagation and culture of plants. [Author's summary.]

10. MUENSCHER, W. C. 635.967.4
Storage and germination of seeds of aquatic plants.
Bull. Cornell agric. Exp. Sta., 652, 1936, pp. 17, bibl. 19.

Seeds of 43 species, representing 30 genera in 20 families, of aquatic or marsh plants growing wild in New York State were harvested as they matured in the autumn of 1935. In each case the seeds were subjected to four storage treatments : (1) Storage in water at 1-3°C., (2) in water

at room temperature, (3) storage dry at 1-3°C., and (4) storage dry at room temperature. Germination tests were made on seeds of each series after approximately 2, 5 and 7 months in storage, and the results indicate that for most of the species tested storage in water at a temperature just above freezing point is the best treatment. Seeds of most species kept in dry storage at 1-3°C., or at room temperature, failed to germinate after 2 to 5 months, in some cases because drying killed the embryo and in others because drying prolonged the dormant condition or caused the seed to become dormant. Similarly, seeds of most species stored in water at room temperature would not germinate after 2 to 5 months due to entering a rest period, but could be induced to germinate by chilling for 30 days after removal from storage. Seeds of *Vallisneria*, *Orontium* and *Nasturtium Nasturtium-aquaticum* (watercress) proved to be exceptions and germinated well 2 months after harvest without chilling. It is concluded that, contrary to opinions expressed elsewhere by certain other workers, the seeds of aquatic plants intended for planting should never be allowed to dry, but should be stored in water at temperatures just above freezing point until planting time in the spring. Such treatment, it is pointed out, most nearly approaches that to which the seeds are subjected in nature.

11. QUARRELL, C. P. 631.588.1 : 631.544
Electric heating of soil in frames.
J. Minist. Agric. Lond., 1936, 43 : 446-52.

The crops grown were lettuce and carrots. Seven ranges were used, each consisting of 41 Dutch lights, 4 being heated by a special 400 watt cable made by Callender's Cable Construction Co. and 3 not being heated. The cables were laid at 8 in. below the surface of the soil, but the experiments indicated that 5 in. or even 4 in. would have been better and would not have caused excessive drying out. The hope of obtaining and keeping a soil temperature of 60°F. at 2 in. below ground level was not fulfilled and day-night fluctuations even in the heated frames were very wide. After 17 days no further current was used owing to excessive expense. It is suggested that the somewhat disappointing results might have been much better if it had been possible to provide adequate thermal insulation for the frames, which was not possible with the method of cultivation adopted, if wind breaks had been used, and if the cables had been laid less deep.

12. TEAKLE, L. J. H. 631.459
Soil erosion and soil conservation.
J. Dep. Agric. W. Aust., 1936, 13 : 273-84, bibl. 11.

A review is given of the situation in regard to soil erosion in America and other countries and of the methods taken to combat it. The object of the paper is to draw the attention of farmers in W. Australia to the dangers which, though at present latent, are none the less real.

13. FEUSTEL, I. C., AND BYERS, H. G. 631.432.4
The comparative moisture-absorbing and moisture-retaining capacities of peat and soil mixtures.
Tech. Bull. U.S. Dep. Agric., 532, 1936, pp. 25, bibl. 10.

The use and benefits of peat as a source of organic matter for improving the physical condition of soils have often been described with particular reference to greenhouse crops and lawns. It has also been frequently claimed that peat greatly increases the water-holding capacity, and hence the available moisture supply, of soils. The present paper describes a study made to evaluate the effect of different types of peat in common use with respect to the moisture relationships involved in the incorporation of such material with soil. Results are discussed in detail. In so far as the supply of moisture available during dry periods to plants in field plots and greenhouse pots is concerned, they indicate little or no advantage from the use of any variety of peat in clay loam soil with the possible exception of decomposed reed peat. Beneficial effects in moisture economy were, however, obtained in quartz sand and to a lesser extent in fine sandy loam soils. The adding of peat to soils for the sole purpose of conserving a supply of available moisture is therefore not recommended, except possibly in the case of a decomposed type of peat

with a sand or very sandy soil. The textural and other physical and chemical effects of peat will, of course, have to be evaluated before any final judgment on its general usefulness can be passed.

14. SWABEY, C.

634.993

Method of killing standing trees.

Trop. Agriculture, Trin., 1937, 14 : 50-1.

The method proposed avoids the felling of the tree, a process which often causes damage, particularly in the case of shade trees over such crops as cacao, is expensive, and often results in unwanted coppice growth from the stump. Girdling is a reasonably good method, being cheap and the results gradual, thus avoiding violent change of micro-climate, but it has the disadvantage that with a shallow girdle it is relatively uncertain owing to the rapidity with which tropical trees callus, and with a deep one the tree may be so weakened as to fall with a gust of wind before the leaves and branches have dropped. The most effective and cheap method is frill girdling which consists of a ring of downwardly directed axe cuts running into one another and forming a groove or trough round the tree. Into this groove is poured a 1 lb. to 1 gall. solution of sodium arsenite (weaker concentrations have proved effective) which in Trinidad has been found sufficient for 40 trees of 2 ft. 6 in. in girth. The poison must be used as soon as possible after the frill girdle has been cut, so that it may enter the transpiration stream, otherwise it can only act by the much slower process of diffusion. The poisoning does not (as has been claimed) render the wood insect proof.

TREE FRUITS, DECIDUOUS.*

General.

15. MARSEILLE, O.

551.56 : 634.1/2

Klima und Obstbau. (Climate and fruit production.)

Forschungsdienst, 1937, 3 : 34-42, bibl. 112.

This summary is chiefly interesting for the literature cited in which the problems of the fruit-grower caused by the incidence of varying temperatures, different light intensities, and large or small precipitation are discussed. The following, among other points, are touched on here. *Temperature.* The average temperature of the year is not so important as that of particular seasons. Thus the average year temperatures of East Prussia and Southern Ontario are similar, but the much greater summer heat in Ontario allows of extensive peach growing, whereas this is impossible in East Prussia. Temperature at blossoming time is also most important. Cold resistance is dependent on variety, rootstock, pruning, soil conditions and consequent nutritional conditions in the plant, position of plantation, and cultivation, whether undercropped or not. Progress in control methods is noted. *Light.* There are indications that many plantations suffer from lack of sufficient light. This problem is under examination at Berlin Dahlem. *Precipitation.* Very gradually data are being accumulated which show the optimum amount of water wanted by different fruit trees under particular conditions, the best times at which to give it and the effects not only on leaf growth, crop and root growth, but also on the subsequent health of the tree. *Phenology.* Phenological data have only recently been collected with enthusiasm. The importance of meteorological studies to horticulture is at last being realized in Germany and steps taken to make appropriate observations in the different climatic zones where fruit is grown.

16. WICKENS, G. W.

634.1/7

The fruit industry in Western Australia.

J. Dep. Agric. W. Aust., 1936, 13 : 288-93.

This article describes the position of the fruit industry in W. Australia at the end of 1935, and reviews its progress during the past 20 years, during which time the total area under fruit,

* See also 239.

except grapes, has decreased by 1,064 acres to 20,741 acres. Nevertheless, the area under productive bearing is greater by 2,000 acres and the average annual production has doubled. The population, however, has increased by 30% in the period. The increased production is mainly represented by apples. The areas under pears, peaches, plums and apricots are all less than 20 years ago, peaches by as much as 50%, and pears by 33%, while oranges are stationary and grapes have more than doubled. The production of pears remains the same, while orange production is 270,000 cases as against 150,000 for an almost similar acreage in 1915-16. The export of fresh fruit made a record in 1935-6, topping the million case mark for the first time. This was largely due to the very heavy apple crops. Imports consist mainly of bananas, but this crop is now being grown in the State. Outbreaks of pests and diseases have been rare and are energetically and efficiently dealt with when they do occur.

17. FAURE, J. 634.13
Les variétés de poiriers de la vallée du Rhône. (**Pear varieties in the Rhone valley.**)

Progr. agric. vitic., 1936, 105 : 226-9, 253-6, 281-3 and 300-3.

The characteristics desirable in pear trees are first discussed under two headings, namely cultural qualities which refer to the tree as a whole, and commercial qualities which refer to the fruit. Descriptions are then given of the principal pear varieties grown in the Rhone valley. These consist of 13 summer varieties, which mature their fruits at the same season as peaches and include such varieties as Williams Bon Chrétien (Bartlett), Dr. Jules Guyot, Clapp's Favourite and Beurré Giffard; 7 autumn pears, which mature their fruit in October and include Beurré Hardy, Duchesse d'Angoulême, Doyenné du Comice and Beurré Clairgeau; and 4 winter varieties in which the fruit usually ripens from December to April. In a few cases rootstocks are mentioned. Quince stocks are used for Dr. Jules Guyot and on fertile soils should also be used for Williams. In both cases a tree of medium vigour is produced. [Elsewhere these combinations have been reported as lacking sufficient compatibility to make satisfactory trees—Ed.] Beurré Hardy and Beurré Giffard will grow equally well on either pear or quince stocks, but Comice should always be worked on quince, or perhaps double-worked, to encourage regular cropping. The author concludes with a discussion on the varieties which should be selected for future planting in the area.

Breeding.

18. VON VEH, R. 631.52 : 634.23
Die Anzucht von Kirschsämlingen aus frischgeerntetem Saatgut. (**Raising cherry seedlings from freshly gathered cherries.**)
Züchter, 1936, 8 : 305-12, bibl. 11.

The author, who has already described the process involved when dealing with apples, pears or quinces,* here deals fully with cherries. He has found by practical controlled experiments that only those stones should be used which, immediately after removal from the fruit flesh and cleaning, sink when placed in water. These will be found to have a well-developed embryo inside. The procedure is as follows:—After testing the stones in water, dry in air for 2 days, thereby making them less slippery for handling and allowing the embryo to shrink slightly away from the wall of the stone and so be less liable to injury in cracking. Crack the stone with a light blow from a hammer on the ridge. Remove the nucellus and seed coat. Put the embryos on moist filter paper in a petri dish at room temperature in diffused light. At the end of a week the cotyledons will have lifted from one another and in most cases become green, while in some a root will have emerged. After about a fortnight they should be removed to moist sand such

* *Ibidem*, 1936, 8 : 145, *H.A.*, 1936, 6 : 4 : 651.

as the root can penetrate or to a layer of 2 cm. cork grains overlying moist sand. When the seedlings have established their roots, sent out a hypocotyl and unfolded their first pair of leaves, they are ready to be moved into a mixture of compost soil and sand. Sweet cherry seed taken and treated thus in June and July will have produced sturdy seedlings with several pairs of leaves by the middle of August. The chief dangers lie in damage to the embryos before treatment and later in the ravages of birds and slugs. As an example of the saving of time involved, the author cites the oldest cherry seedling raised by him in this way. The embryo was removed from the seed and put in a petri dish on 3 July, 1935. On 1 September, 1936, it was 14 months old and as regards physiological development was at the end of its second growth period, since it first became dormant at Christmas 1935 and restarted growth at the beginning of April 1936. On 1 September, 1936, the plant was 81 cm. (or 32 in.) high, had 1 main shoot with 2 side shoots and 55 leaves in all, the longest leaf with stalk being 13.5 cm. in length. Attempts to raise seedlings in this way were unsuccessful unless the nucellus and seed coat were previously removed. This agrees with experience with apples, pear and quince seed and the possible reasons for this are discussed. Further experiments indicated that drying the embryos for some days prior to putting in petri dishes does not deprive them of their germination capacity.

19. PIROVANO, A. 634.23-1.52
 Miglioramento genetico del pesco. (Improvement of the peach by breeding.)
Ital. agric., 1936, 73 : 711-22.

The author gives a brief account of the fruit characteristics of some 38 peach hybrids raised by him at Belgrate and at the Electro-genetic Station of Grotta Rossa near Rome. The varieties chosen as prototypes were generally very fertile American varieties and the attempt was made to correct defects in an otherwise good type by crossing with a type that did not show those defects. As an instance, Hale, a variety whose fruit often has a somewhat bitter tang in the North of Italy, was crossed with Free Yellow, a small but very delicately perfumed variety. The criterion of selection is to limit choice to varieties which under Central Italian conditions will show the following characteristics:—(1) Constant cropping whatever the weather conditions in spring may have been, (2) sufficient size and uniform consistency in fruit, (3) excellent flavour and aroma even when not quite ripe, (4) comparative resistance to *Puccinia*, and (5) vegetative vigour. The technique differs from that formerly adopted, in that the pollen is always taken from plants grown in soil of quite a different character to that in which the other parent is growing, and secondly it is treated with alternating magnetic fields of low and medium frequency and with ionizing rays. These first tentative treatments, in which it was uncertain what strengths of current could safely be used, did not result in such surprising results as were achieved in similar hybridizing experiments with table grapes. Still, compared with the control hybrids derived from the use of the same pollen on the same trees but without electric treatment, the electro-genetic hybrids are noticeable for the greater size of fruits and for late ripening.

20. HILKENBÄUMER, F. 581.142 : 634.2
 Versuche zur Behebung des Keimverzugs bei Steinobstsamen und zur Klärung seiner Ursache. (Attempts to eliminate delay in germination in stone fruits and of determining its reason.)
Landw. Jb., 1936, 82 : 883-924, bibl. 42.

The varying percentage germination of the seeds of cherries, plums and peaches in the year of planting led the author to investigate some of the aspects of the problem, and in this paper he gives an account of his investigations in 1933 and 1934 with seed [actually, as received, fruit with stones inside—ED.] of mahaleb, bird cherry, acid cherry, St. Julien, myrobalan, peach and sloe. The origin of all the seed used was known. Trials of each particular parcel of seed were triplicated, 100 seeds being used for each, involving some 150,000 altogether. Sowing was done in pots in a cellar store where the temperature remained at 8-10°C. and in cold frames in the open. In order to ensure uniform moisture conditions the pots were lined with peat mould and

covered in most cases with a layer of the same material about 3 cm. thick, while in some was put a 25 cm. layer of soil. Sand was used for the germination substratum. Trial was also made of a mixture of sand and peat mould, as also of rich garden soil. The author summarizes as follows:—(1) The stones of different trees of a stone fruit variety, both from the same place and from different places, show great differences in the number of germinating and rotting seeds. The effect of not removing the fruit flesh immediately after harvesting or of letting it ferment for a time is very detrimental to germination. (2) Of the 4 media, viz. sand, peat, sand and peat, peat and soil, peat was the best for earliness and speed of germination. Only in the case of mahaleb and peach, however, was peat found to increase the actual percentage of germination. (3) Cold and changing temperatures in the storeroom adversely affected germination percentage except in peaches. Germination was hindered by temperatures of more than 12°C. in the medium. Optimum temperatures were found to vary with the variety. (4) Submitting air-dried seed to low temperatures, viz. -10° to -65°C., had no effect on germination. Previous steeping of seeds in tap water at 12°C. had no effect on germination except in the case of mahaleb, where it was favourable; steeping at 24°C. was generally detrimental. (5) Submitting to alternating conditions of moisture and dryness only increased germination in the case of seeds stored for a long time under damp conditions. If air-dried seeds were submitted to these alternating conditions, germination was generally hastened, but the percentage germination fell owing to increased number of rotting seeds. (6) Cracking the shells accelerated germination but resulted in decreased number of seeds germinating, which was very noticeable in the seeds sown in soil. Subjecting the seeds to rubbing by rotation in a drum was detrimental to speed and percentage of germination. (7) Germination was found to be unfavourably influenced by the following treatments: treatment with concentrated sulphuric acid; steeping in pepsin hydrochloric acid in the case of bird cherry, sloe and peach; steeping in potassium thiocyanate in peaches in cellar and in open, and St. Julien and myrobalan in cellar. In the other varieties the two last named treatments had no definite effect. Treatment with hydrogen peroxide increased germination percentage in mahaleb, but greatly decreased it in bird cherry and sloe. When chloride of lime was used for steeping and the stones were left uncracked, increased germination was achieved only in the case of mahaleb. If, on the other hand, the uncracked seeds were steeped in vacuo or the seeds were shelled prior to being steeped at normal pressure, increased germination resulted except in the case of sloe (indifferent) and bird cherry (damaged seed). Generally speaking, treatment with chemicals accelerated germination, especially that with chloride of lime in vacuo and of shelled seed under normal pressure. (8) The above data show clearly that the presence of the fruit flesh both hinders and is detrimental to germination. The presence of the stone shells only check germination to a limited extent in seeds germinating in the first germination period. The reason for delayed germination in the remaining seeds must be sought in their specific characteristics; which means that it is dependent on internal features and is not due to environmental factors.

21. BRYANT, L. R.

634.11 : 581.141

A study of the factors affecting the development of the embryo-sac and the embryo in the McIntosh apple.

Tech. Bull. N.H. agric. Exp. Sta., 61, 1935,* pp. 40, bibl. 33.

Experiments have shown that McIntosh, a diploid variety, is practically self-sterile and in addition will not produce commercial crops when pollinated with the important triploid varieties, Baldwin and Gravenstein. A number of diploid apples, however, has been found to supply suitable pollen for McIntosh, and of these Delicious in particular has given consistently good results. Both self- and cross-sterility are thus involved in the problem of pollinating McIntosh, but it is considered that, in connexion with cross-sterility, the low percentage germination of the pollen of the triploid varieties may not be the only explanation of their failure as pollinators. To elucidate this, emasculated stigmas of McIntosh were pollinated with pollen from McIntosh,

* Received March, 1937.

Baldwin, Gravenstein and Delicious in order to determine the effect of pollen tube growth through the style on the length of time the embryo sac, or more particularly the egg, remains functional in the absence of fertilization. In cases where fertilization occurred the development of the embryo and endosperm was also studied. A detailed description of the procedure employed is given. It was found that the pollen of all the varieties stimulated pistil development to some extent, but that pollen from Delicious was much more effective than that from the other varieties. A correlation was found to exist between the effectiveness of a variety of pollen used and the number and vigour of the female gametes developing. The more effective pollinations prolonged the functional life of the egg, produced the earliest and most rapid development of the embryo, and not only delayed the initial appearance of embryo abortion, but also decreased the number of instances in which it occurred. This greater stimulation and vigour resulting from effective pollination was further manifested in endosperm development. It is concluded that failure to set fruit in McIntosh is not due to lack of functional pistils; nor can it be adequately explained by slow pollen tube growth when its own pollen or that from triploid varieties is employed, since in both cases it was observed that embryo development started, but was followed by early abortion. Where triploid pollen is used it is suggested that irregular chromosome distribution is responsible for embryo abortion, but so far there is no adequate explanation of embryo abortion in self-pollinated flowers. P.K.S.

22. TUKEY, H. B. 634.22 : 581.145.2
A relation between seed attachment and carpel symmetry and development in *Prunus*.
Science, 1936, 84 : 513-5, bibl. 7.

In connexion with more detailed studies of the developmental morphology of fruits of *Prunus Persica*, *P. domestica*, *P. insititia*, *P. salicina*, *P. americana*, *P. Avium*, *P. Cerasus* and *P. Armeniaca*, a relation has been found between carpel development and the position of seed attachment. The fruit of these species contains a single carpel. On either side of the ovarian cavity an ovule is attached, one of which normally aborts, while the other develops into a seed. Many of the fruits are asymmetric, the one side being more developed than the other, and differing from it in a number of other respects. Examination of the stony pericarp and the point of attachment of the seed has shown that in asymmetrical fruits the seed is attached to the larger and better developed side of the carpel. A ready explanation of this effect is offered by the arrangement of the vascular system of the fruits. The two ventral bundles which supply vascular connexion to the ventral region of the fruit have been shown to be widely separated morphologically, although adjacent in their position in the fruit. It is therefore concluded that the greater development of the side of the carpel to which the embryo is attached is the natural result of the establishment by the growing embryo of a deficiency gradient towards which food materials move.

*Propagation.**

23. DUFOUR, A. 631.541.5
 Variante proposée aux greffeurs en écusson. (**A modification in the method of taking shield buds.**)
Rev. hort. suisse, 1936, 9 : 222-3.

It is suggested that shield buds might be taken by making a transverse cut below the bud and drawing the knife underneath it for 5 or 6 cm., completing the final removal by tearing so as to leave a long strip of rind. To do this the bud-wood shoot is held in an inverted position. When the operation is completed, the shield is handled by the strip of rind instead of by the leaf petiole, the strip being cut off as soon as the bud is inserted in the stock. The operation is clearly illustrated in diagrams. The principal advantage claimed for the method is that the leaf petiole, which is often very small and easily soiled by the fingers in the ordinary method,

* See also 9.

need never be touched. The method is simple and is therefore recommended for persons unskilled in the art of budding, and in particular where there is a large core of wood to be removed. [The method described here is that used normally at East Malling.—ED.]

24. KEMMER, E. 631.541.44 : 634.11 + 634.13
 Ergebnisse eines zweijährigen Umpropfversuches. (**Results of a two year
 topworking trial.**)
Gartenbauwiss., 1936, 10 : 451-69.

The purpose of this experiment was to throw as much light as possible on the inter-relation of stock and scion in topworking. The test trees consisted of bush trees about 30 years old growing at Berlin Dahlem, 76 apples including 69 varieties on Doucin and 63 pears including 55 varieties on seedling rootstocks. Part of the trees, 26 in all, had already been topworked many years ago. They were now topworked at the ends of the branches, each apple branch receiving Goldparmäne as a scion on one side and Boskoop on the other, each pear branch Gräfin von Paris and Alexander Lucas. Of the 278 grafts inserted, only one failed to grow. Tables of growth measurements in both cases and illustrations of vertical section through some of the joints at the end of two years are given. The author sums up as follows :—There was no correlation between growth of scion and previous cropping of the intermediate, nor did comparison of results on diploid and triploid varieties yield any definite result. A positive correlation was, however, found between scion growth and the strength of growth of the intermediate. The natural growth capacity of the scions became evident, Boskoop and Alexander Lucas scions growing more strongly than those of Goldparmäne and Gräfin von Paris. It was observed that callusing was best where the lowest scion bud was just above and not opposite the union. First year's scion growth, compared with second year's growth, was as 1 : 3. In the first year three-quarters of the whole year's growth was accomplished by the end of June. Despite the use of identical wax by the same person the amount of dead heart wood in the centre of the grafted branch varied greatly, even when the variety worked was the same. The amount was unconnected with the growth capacity of the scion : often, when scion growth was poor, there was little or none of it and similarly, when scion growth was good, there was frequently a large area of this wood. The amount and lightness or darkness of colour of this wood gave no indication of the quality of the wax used or of the growth capacity of the scion.

Rootstocks.

25. HEARMAN, J., AND OTHERS. 634.11-1.541.11
The reinvigoration of apple trees by the inarching of vigorous rootstocks.
J. Pomol., 1937, 14 : 376-90, bibl. 10.

The material used in the experiment and for comparison was 12-year-old bush trees of Grenadier apples on Bristol OF5, Malling II, Northern Spy and Malling Crab H layered rootstocks, 4 of the most stunted and scorched trees on Crab H and 3 on Northern Spy being inarched with Malling XVI, a layered rootstock known to impart vigour to scions. The stocks were planted in February 1934 close to the base of the trees, care being taken not to disturb the existing roots. Three methods, which are described, were used with equal success. Treatment of individual trees varied from direct inarching of a rootstock into a single branch to the inarching of 2 or 3 rootstocks into one side of a tree. In addition to the 7 bush trees, one half-standard Grenadier on Northern Spy was inarched with 3 XVI stocks on one side of the stock. Although the operations were only performed in 1934, the inarched trees were already showing considerably increased vigour by the end of the third growing season, i.e. autumn 1936. The main effect was shown by the particular branches of the tree which were in direct vascular connexion with the rootstocks. In the case where a branch was inarched, this branch showed increased growth independently of the other branches. This means that a single tree can be used as a "plot" in which the behaviour of other branches acting as a control shows up the effect of the inarching. When the rootstocks were inarched into woody strands which divided at the main crutch and

ran into two or more branches, the whole tree was affected. The observations show the need for care in selecting the point at which to apply the inarch, especially if the trunk has a spiral twist. The experiments were of particular interest in that they gave a clear indication of the way in which root systems of different rootstocks, which start from approximately the same point and have the same soil from which to choose, distribute themselves differently in the soil.

26. QUINN, G. 634.1/2-1.541.11
The State Experiment Orchard, Coromandel Valley, near Blackwood, South Australia.
Bull. Dep. Agric. S. Aust., 311, 1936, being records of some departmental work, pp. 1-144.

This report on trials of rootstocks for deciduous fruit trees covering the period 1904 to 1934 has already appeared as a series of articles in *J. Dep. Agric. S. Aust.*, 1935, vols. 38 and 39. The section on rootstocks for pear trees has been abstracted in *H.A.*, 1935, 5 : 3 : 338, that on cherries *Ibidem* 339, and that on peaches *Ibidem* 340, while an abstract of the section devoted to rootstocks in relation to the occurrence of bitter pit in apples may be found in *H.A.*, 1935, 5 : 4 : 590.

27. DE HAAS, P. G. 581.144.2 : 631.541.11 : 634.11 + 634.13
 Studien über die "Freimachung" an 27-jährigen Birnen- u. Apfelbusch-
 bäumen. (Studies of scion rooting in 27-year-old pears and bush apples.)
Gartenbauwiss., 1937, 10 : 610-50, bibl. 42.

The observations were made on similarly treated trees on Angers quince and Jaune de Metz rootstocks of the following pear and apple varieties :—pears : Edelcrassane, Vicar of Winkfield, Bergamotte d'Esperens, Diels Butterbirne, Louise Bonne, Alexander Lucas, Duchesse d'Angoulême ; and apples : Biesterfelder Reinette, Peasgood's Reinette, Belle de Boskoop, Transparent de Croncels, Berlepsch Goldreinette and Graue Französische Reinette ; in all 120 pears and 180 apples, 27-years-old, growing at Dirmstein in the Palatinate. They were excavated in 1934. With numerous illustrations the author describes the different root growth phenomena observed. He concludes as follows :—Scion rooting capacity is hereby proved to be a marked varietal characteristic. Weakening of the rootstock has no effect on scion rooting. Incompatibility and scion rooting are entirely unconnected. The same holds good for swelling at the union and scion rooting. There is no clear evidence of any connexion between vigour and scion rooting. Investigation is necessary to decide whether there is any connexion between rooting capacity of young shoots and scion rooting. The effect of pronounced scion rooting on wood growth is strong, and where scion rooting only occurs on one side, its effect may often be seen also on the other. Quince rootstocks worked with weak growing pear varieties are apt to fall off so much in yearly growth increase after about 10 years that the yearly rings can no longer be distinguished and in fact are sometimes not formed. When scion rooting is very pronounced, the quince often dies completely without any preliminary period of lessening yearly increment. In the case of the Jaune de Metz this stock was found to show considerably decreased growth increment when there was much scion rooting, but in all cases it survived and in no case was it impossible to observe annual rings. The strength of both the quince and the Jaune de Metz stocks is directly proportional to that of the scion. This determination, however, only has relative value, since the varieties themselves develop very differently on the weak growing rootstocks and on seedlings of the same species. The reaction differs with individual varieties. Hence observations on the vigour of varieties must always be understood in relation to the rootstock. The effect of scion rooting on cropping needs systematic investigation in trials laid out for that purpose. It was impossible to gauge the variability of own rooted trees owing to the impossibility of knowing exactly when each tree became fully scion-rooted. Yearly growth increment is generally liable to a definite periodicity which is closely connected with the fluctuations due to climatic conditions, namely strong and weak growth periods. Growth increment in Jaune de Metz is less variable than in quince. It is higher in Jaune de Metz than in the apple scion varieties and lower in the quince rootstocks than in the pear scion varieties.

Rootgrowth.

28. MARANI, M., AND OTHERS. 634.25-1.536 : 581.144.2

Ricerche sulla formazione di radici nel pesco durante l'inverno e conseguenza circa la messa a dimora delle piante. (*Investigations on the root growth of peaches in winter and whether it should influence planting times.*)

Riv. di Frutticoltura, 1937, 1 : 3-34, bibl. 20.

The soil is alluvial, the top soil of 45 cm. in depth having an ideally mixed consistency of clay and sand. The next layer of a few cm. only consists of grey-coloured sand. In the third stratum of 15 cm. the clay particles predominate and make it fairly compact. The fourth stratum of 30 cm. is again sandy and friable. The fifth is composed chiefly of clay, which is again followed by sand, while the area between 1.1 and 1.6 m. is very compact. Two double series of maximum and minimum thermometers were set up to register temperatures at depths of 15 cm. and 30 cm. Further, a rain gauge measured the rain which fell during the experiment, i.e. from 1 November, 1935, to 31 October, 1936. The seedling peaches were taken direct from the nursery with as little damage as possible to the roots. The side shoots were removed and the main stem lopped at 50 cm. from the collar. The diameter of the stem was measured. After this treatment the seedlings were planted in ground worked to a depth of 45-50 cm. to which no nutrients of any sort had been previously added. Planting was done with 25 seedlings in each row, the distance between the rows and between each seedling being 1 m. The plan of operations was as follows :—1 November, 1935, planting of 125 seedlings designated group I ; 30 November, planting 100 similar seedlings (group II) and removal of 25 group I ; 30 December, planting 75 seedlings (group III) and removal of 25 of both groups I and II ; 30 January, 1936, planting 50 seedlings (group IV) and removal of 25 of groups I, II and III ; 2 March, planting 25 seedlings (group V) and removal of 25 of groups I, II, III and IV. Finally on 5 November, 1936, a start was made in the removal of the 25 seedlings originally planted on 1 November, 1935, and the 25 planted on 2 March, 1936. In all cases careful measurements were made. Results of these are tabulated and photographs are given of carefully excavated trees of these two groups, as well as projections on a horizontal plane of their root systems. The following conclusions are reached :—(1) The formation of new roots and their growth continued throughout the winter of 1935-6, a period within which the mean of the minimum temperatures during the second fortnight in December at a depth of 15 cm. below soil level was 2.2°C. (35.8°F.). (2) The greatest mass and length of new root formation, determined on 2 March, 1936, was found in the group planted on 1 November, 1935, exceeding that produced by the seedlings planted on 30 November and 30 December. (3) At the end of the 1936 growth period (2 March to 1 November) the average increase in stem diameter, the average weight of roots, average weight of stem and branches of the group planted 1 November, 1935, were appreciably greater than those of seedlings planted on 2 March, 1936. (4) Under such soil conditions as have been described above (and possibly under others), especially in the case of plants transplanted from the nursery in the autumn, the roots may in the course of one growing season grow so vigorously as to reach a depth of 1.5 m. with a lateral spread of 1.25 m. Autumn planting of peaches has, at least as regards one year's growth, given much better results than late-winter planting. (5) In such soil the first year's root growth goes far beyond the limits of the normal holes made for planting, i.e. 1.1-2 m. \times 0.8-0.9 m.

*Pollination.**

29. NEBEL, B. R., AND RUTTLE, H. L. 581.331.2 : 634.1/8

Storage experiments with pollen of cultivated fruit trees.

J. Pomol., 1937, 14 : 347-59, bibl. 14.

The authors tabulate and discuss the results of other workers in this field. They then describe their own experiments. The pollen of cherry, apple, peach, plum, pear, grape and apricot was collected from unopened flowers or from flower clusters which had been protected by bags. The anthers were removed and allowed to dehisce at room temperature in petri dishes protected

* See also 21.

from insects. After a period of 1 to 7 days the pollen was transferred to shell vials loosely stoppered with cotton wool. These were placed in desiccators in a dark room at a temperature of 2-8°C. The desiccators were kept at calculated humidities of 50, 60, 70, 80, 90 and 100% with sulphuric acid-water mixtures. Pollen was germinated on 0.5% agar containing 10% or 20% sugar. Germination counts were made from 4 to 24 hours after the pollen was put on to the medium. Lacmoid stain was used to distinguish the grains. Results are graphed and tabulated and summarized as follows :—"The period of life of pollen of apple and cherry, stored at 2-8°C., increases with decreasing humidity from 100% to 50%. At 50% humidity it was found that pollen of apple and sour cherry still showed good germination after more than two years' storage. It is indicated that under these conditions the pollen of pear, plum, peach, sweet cherry and grape may also be kept for two years. Stored pollen was used in fertilization tests and gave plump seeds wherever it was found to possess good vitality in the germination tests. Apple pollen which had apparently lost its viability after being stored in the laboratory for five weeks was revived by being placed in storage at 2-8°C. and 80% humidity."

30. BOVEY, P. 581.162.3 : 634.11 + 634.13
 La découverte de l'interstérilité chez les pommiers et poiriers. (**The discovery of inter-sterility in apples and pears.**)
Rev. hort. suisse, 1936, 9 : 25-8, bibl. 4 in text.

An outline is given of work done by Kobel and Steinegger,* who discovered that inter-sterility existed in three groups of apples and pears. Inter-sterility was proved to exist in apples between Rose de Berne and Parkers Pepping (pippin) and between Reinette d'Oetwil and Reinette d'Oberried, and in pears between Williams Bon Chrétien and Louise Bonne d'Avranches. All these varieties are diploids possessing fertile pollen, and it has been shown that failure to effect cross-fertilization is due to cessation of growth of the pollen tube when not more than one quarter of the way down the style. It is noted in addition that all apples and pears are self-sterile, which is also associated with failure of the pollen tubes to reach the ovules, and that a number of triploid varieties produce sterile pollen. Some 31 apple and 24 pear varieties producing good pollen and 11 apple and 6 pear varieties producing bad pollen are listed in groups according to their season of blossoming.

· *Growth, Nutrition.*

31. GARDNER, V. R. 634.23
Factors influencing the yields of Montmorency cherry orchards in Michigan.
Spec. Bull. Mich. agric. Exp. Sta. 275, 1936, pp. 18, bibl. 4.

The factors considered here are (1) age of tree, (2) soil, (3) site and locality, as associated in particular with variations in climatic conditions, and (4) fruit setting. No attempt is made to show that any one of these factors is, in general, more important than another, but data collected over a number of years are presented to show something of the frequency and extent to which they curtail yields. *Age of tree* :—A graph is given based on a large number of records showing the relationship between age up to 25 years and yields. The Montmorency cherry in Michigan starts to bear at 5-6 years old, gradually increases in productivity up to 20-22 years old and then declines, more or less rapidly as the case may be. *Soil* :—Comparisons between a random sample of trees of 44 representative orchards and certain selected "standards" based on trees growing in good soils indicate that on the average Montmorency trees in Michigan attain only three-fourths of the size, as estimated from trunk circumference, and the productivity that would be possible were they planted on first-class land. *Site and climatic influences* :—Yield records taken between 1920 and 1934 and covering 3-9 years each, for a random sample of 422 orchards, show that on the average one crop out of three is lost because of spring frosts, which in turn are associated with unfavourable sites and localities. In orchards on the best

* Die Befruchtungsverhältnisse von Apfel-u. Birnensorten u. der Nachweis von Intersterilität bei denselben. *Landw. Jb. Schweiz.*, 1934, pp. 741-68, *H.A.*, 1935, 5 : 2 : 180.

sites, representing about one-third of the total, loss of the crop from frost occurs less frequently than once in five years. *Fruit setting*:—Variations of from 10% to 50% in percentage of blossoms setting and maturing fruit are common. Observations in two orchards suggest that differences in fruit setting were attributable mainly to differences in the abundance of pollinating insects, notably bees. Yields are also discussed in relation to costs and prices, and it is concluded that, under present conditions, substantial profits can only be realized where production costs per pound can be kept low by obtaining yields well above the general average of 50 lb. per tree per annum.

32. FANELLI, L. 634.25 : 581.145.2
 Osservazioni su la cascola nel pesco. (*The fall of fruit buds in the peach.*)
Ital. agric., 1936, 73 : 909-20, bibl. 12.

Five years' observations at the Stazione Agraria of Bari, southern Italy, on premature fall of peach buds are here tabulated and summarized as follows:—In the peach, in addition to the ordinary fall of buds at the time of fruit setting and after, there is also a fall of flower buds prior to flowering, its intensity varying with the variety and the state of the plant. It is greater in young than in adult trees. There is considerable varietal difference in the tendency of different varieties to exhibit this feature. Most commonly affected are the early varieties such as Maggiarola, Amsden and Maddalena. The semi-early American varieties Triumph, Waddell and Mamie Ross are less prone to be affected the less early they are. Elberta and Hale, and the Italian Percoca and Poppa di Venere are not so susceptible. The varieties or individual plants less subject to this fall are accustomed, in the course of time, to experience a heavy post-flower fall, and this generally occurs after a particularly fruitful year. It may also be noted that in susceptible varieties the fall is less than usual after a year of scanty production. This connexion between fall and exhaustion of the plant allows one to distinguish whether the fall is due to internal regulatory processes or to external phenomena. The pre-blossom fall depends on meteorological factors, chief of which are the sudden drops in temperature which are incurred by the buds just starting into growth. In the pre-blossom period the minimum temperature is probably about -2°C . rising to $+3^{\circ}\text{C}$. as the season goes on. The actual diurnal variation in temperature is more important than the minimum, and sharp falls in temperature below $+5^{\circ}\text{C}$. result in fall of flower buds at all stages and of the small fruits up to the end of May. Light also plays its part and the fall of flower buds, of flowers, and of just forming fruits increases after a period of dull days. Wind is the third factor responsible for bud fall, which it induces by removal of flowers, buffeting and breaking of twigs or drying up the young growth. Its harmful action begins with the opening of the buds and continues till harvest. High atmospheric humidity would appear to favour blossom fall, whereas after flowering humidity of soil would tend to check fruit fall. Violent rains do mechanical damage to the flowers, removing the pollen, washing the stigma, and tearing the petals so that fertilization is prevented. Fall after flowering is, on the other hand, caused mainly by internal factors, though it is undoubtedly influenced by sudden falls in temperature and wind. Bud and flower fall is in all cases under all climatic conditions worse after a year of abundant cropping. The phenomenon of premature fall is of the greatest importance, and susceptible varieties which have otherwise everything to commend them should not be planted.

33. TOKINGAWA, Y., AND YUASA, A. 634.451 : 581.192
 Notes on the tannin cells of persimmon. [Japanese, English summary.]
Bot. Mag. Tokyo, 50, 1936, pp. 277-83, abstracted in *Jap. J. Bot.*, 1936, 8 : (85) : 349.

According to the observations mentioned in this paper, some cells of the floral organs in the fruit flesh of sweet Japanese persimmons are suddenly transformed into tannin cells, inasmuch as tannin substances accumulate in the vacuoles in a dissolved state. As the fruit ripens the tannin cells increase in number and size until they become hardened and sweet. Meantime the nucleus, cytostome and other cell components become coagulated, while the cell walls undergo

no change at all. The authors have applied several reagents to cause the hardening, e.g. absolute alcohol, acetone, acetic-aldehyde, aqueous solution of potassium bichromate and of chromic acid, high percentage alcohol, and have by them produced hardening similar to that which occurs naturally. [From abstract in *Jap. J. Bot.*]

34. CULPEPPER, C. W., AND OTHERS.

581.192

The determination of the internal gases of plant tissues.

Science, 1936, **84**: 398-400, bibl. 5.

In view of the tedious nature of analysis by the Bonnier-Mangin gas apparatus used for extracting the internal gases of plant tissues, the apparatus was discarded in favour of an Orsat gas analysis apparatus. This apparatus necessitates supplying larger quantities of gas, and a larger extraction cylinder had to be provided. This cylinder is described here with the aid of a diagram. It has been used successfully with fruits of the egg-plant, pumpkin and Kieffer pears, duplicate determinations checking very closely. About 15 to 20 minutes only were required to prepare the material and extract and analyse the gas by this method. The literature on the internal gases of plant tissues, as related to the author's findings, is discussed briefly.

Manuring, Cultural practice.

35. MURNEEK, A. E.

634.1/2-1.84

Fertilizing fruit trees with nitrogen.

Bull. Mo. agric. Exp. Sta. **363**, 1936, pp. 20.

Suggestions and recommendations are made for the use of nitrogenous fertilizers in orchards in Missouri, where the main fruit crops are apples, peaches and cherries. The forms of fertilizer discussed include stable manure, green manure from leguminous cover crops, nitrate of soda, sulphate of ammonia and calcium cyanamide. The following are some of the points noted:—Experiments with apple trees have shown that nitrogen fertilizers may be supplied with as good results in the autumn as in the spring. Where spring applications are to be made, nitrate of soda should be applied not later than 3 weeks, sulphate of ammonia about 4 weeks and calcium cyanamide about 6 weeks, before blossoming. In Missouri, autumn applications may be made at any time between late September and early November. Varieties like York and Wealthy, which show a distinct biennial bearing tendency, should not be fertilized every year as this will encourage further overbearing in on-years, but should receive nitrogen only in the spring of the off-year, and, where this is insufficient, in the autumn of the off-year as well. Peach trees which have become devitalized should receive nitrogen whether a crop is expected or not. If they are expected to set fruit, nitrogen should be applied, as soon as the danger of spring frosts is over, in proportion to the anticipated crop. Sour cherries are usually fertilized in the spring about the time the buds begin to swell, but slower acting fertilizers such as cyanamide are better applied in the autumn. Amounts of fertilizer to apply:—Young apple trees up to 4-5 years old in cultivated soil may grow well without added nitrogen, but when in sod should receive about 3 oz. of a 20-21% fertilizer or 4 oz. of one containing 16% nitrogen per annum. The stone fruits should receive slightly less than this up to 4-5 years of age. For mature apple trees growing in sod the general rule is to apply $\frac{1}{4}$ lb. of a 20-21% fertilizer for each year of age of the trees. It is estimated that a 20-year-old bearing apple tree requires about 2 lb. 20-21% fertilizer to replace the nitrogen removed with the crop, 0.5 lb. to replace losses by pruning, 2 lb. for leaf fall, 0.3 lb. for nitrogen lost in the dropping of blossoms and young fruits and 1 lb. for maintenance of growth. Of the losses about 1.2 lb. is returned to the trees when the flowers and leaves decay in the soil, which leaves a net requirement of 4.6 lb. of 20-21% nitrogen fertilizer per tree. Using $\frac{1}{4}$ lb. increase per annum as a basis, the amount supplied would be 5 lb. A similar rating is suggested for peaches and cherries up to 2 lb. per tree, or, if broadcast, up to an amount not exceeding 200 lb. per acre. The effects of nitrogen fertilizer on growth, leaf size and colour, set of fruit and size and colour of fruit are discussed. Nitrogenous fertilizers tend to delay the time of ripening, especially of peaches and to some extent of apples, but not of cherries. The claim

that nitrogenous manuring detracts from the keeping quality of winter apples has not been substantiated in trials, but it is possible that excessive applications of nitrogen combined with abnormally heavy rainfall may produce this result. Jonathan apples, pears and quinces should be fertilized with moderation because of their susceptibility to fire blight. In the case of other diseases, however, increased vigour due to nitrogen is associated with increased resistance to disease and greater powers of recovery. This applies also to winter hardness except where nitrogen encourages late growth, but not to drought resistance, which is reduced. Finally, the question of manuring in relation to other orchard practices is discussed.

36. ANAGNOSTOPOULOS, P. T. 631.67 : 634.1/2
Moisture requirements of trees related to irrigation and tillage of the soil.
 [Greek, English summary.]
Hort. Res. Athens, 1936, 1 : 5-28, bibl. 12.

Experiments at Athens during the summers of 1933 and 1935 show that a light cultivation to a depth of 3 inches 2 days after irrigation was very efficacious for preserving moisture. The temperature of the soil on the cultivated irrigated areas was on the average 2 or 3 degrees less than that in the irrigated, but not cultivated, areas. The best results in mature orchards were got from irrigation plus tillage, the irrigation being done at intervals of 20-30 days with 243 tons of water per acre. Results of different treatments are tabulated. [From author's summary.]

37. DOTTI, F. 631.542 : 634.11
La curvatura dei rami in sostituzione alla potatura di formazione nell'allevamento del melo. (Bending as a partial substitute for pruning in apple tree building.)
 Published by Cattedra ambulante d'agricoltura della Provincia di Ravenna, 1936, pp. 27.

The author's experiments lead him to urge the adoption of a system of training apple trees in which bending of branches partially takes the place of pruning. The apple tree which is the model in the orchards of the Province of Ravenna is generally divided at about 60 cm. or nearly 2 ft. from the ground into three branches which further subdivide once at a height of 1.3 m. or roughly 4 ft. The normal habit is to remove yearly from the end of the previous year's growth whatever shoots or twigs do not conform to such an arrangement and to tip the main branches. He does not suggest that the main branches shall be so bent, but he does urge that some of the remaining new growths which are pressing against other growths and would ordinarily be pruned off should instead be bent down out of the way. He considers that normal drastic pruning, while necessarily cutting down net increment, tends to promote excessive vegetative growth and to postpone cropping. By bending the branches instead of cutting it is ensured that these branches are still in a position to carry on the work of assimilation. Moreover, bending does not modify the top : root ratio, but merely tends to direct the flow of sap towards other parts of the top. Meantime the plant can carry on both its vegetative and productive activities, much in the same way as unpruned plants. The bending is only done during the juvenile period of the tree's life. During the period of preponderatingly vegetative activity, bending can with advantage be substituted for pruning, since every cut spared aids net increment and accelerates fruiting. But once this period is over, which will be 5 or 6 years in the case of an apple, this formation pruning loses its predominating importance and its previous harmful influence on the development and productivity of the plant becomes negligible. Consequently there is no further need for bending rather than cutting, and it is abandoned. The author gives figures for 24 young Gravenstein apple trees on doucin, half of which were pruned ordinarily and half submitted to the bending process. Results are tabulated. The following notes are taken from the author's summary. In the first year of the experiment, the production factor not yet having entered in, bending resulted in increased growth increment and more numerous fruit buds. In the 4 years of the trial the average yearly growth increments were generally higher in the rows where bending was practised than in the others, 1934 providing a slight

exception. Over the 4 years the final growth increment of the "bent" apple trees was 98.1 cm.² as against 90 cm.² of the normally pruned trees. Production started in both lots in the second year, the comparative crop figures being 61.1 kg. and 26 kg. per plant, and over the 4 years 166.1 kg. and 112.4 kg. per plant in the bent trees and in the normally pruned trees respectively. In other words bending resulted in stronger growing and more productive plants. The illustrations and tables are helpful in substantiating these claims.

38. ROVENTINI, A. 634.63-1.542
 La ricostituzione olivicola attraverso la potatura. (**Rejuvenation of the olive by pruning.**)
Ital. agric., 1936, 73 : 517-27.

This paper deals with two subjects, namely (1) methods of bringing neglected trees back into adequate cropping, and (2) suggested methods for pruning the olive from the time when it is budded and planted out in the field, the objects in both cases being to establish and preserve equilibrium between all parts of the plant. Illustrations, both photographic and diagrammatic add to the value of the article.

39. SWARBRICK, T. 634.993
Methods of hedge and tree-stump clearing.
Bull. Minist. Agric. Lond., 101, 1936, pp. 16.

The purpose of this bulletin is to describe the various methods and devices that may be employed in the grubbing and clearing of hedges, orchards and large single trees. No one method is always the most economical, and the choice of method to be used will depend largely upon the extent and urgency of the work in question. The methods fall naturally into 4 groups :— (1) Hand-operated methods, involving the use of hand labour with spades, picks, mattocks, etc. only, or the use of hand labour in conjunction with timber jacks and monkey winches. The timber jack is particularly suitable for grubbing stumps which have been cut off at ground level and thus do not provide adequate facilities for attaching a haulage cable. The cost of an English timber jack capable of lifting 10-15 tons is about £15 complete with all accessories. The monkey winch is better adapted to the grubbing of single trees than of hedges, but, where tractor haulage is not available and the use of explosives not convenient, it can undoubtedly be used economically for both types of clearing. The British made Trehwalla monkey winch costs about £50 with all necessary equipment, but for simple work the essential parts can be purchased for about £25. (2) Power-operated methods. Steam engines with winding drums can be hired at a rate of 8s. to 12s. per hour depending on the locality. In orchards this tackle is capable of grubbing 20-40 trees per working hour if the grower supplies a horse to haul out the tackle, and two additional men to assist in the work. The cost per tree then works out at 6d.-9d., and, when preliminary trimming of branches and removing the stumps from the site are included, a generous allowance would be 1s. to 1s. 3d. per tree. Farm tractors, particularly of the caterpillar type, may be used effectively to clear all but the largest fruit trees. The Edwinston tractor winch, costing about £50 and made specially for fitting to Fordson agricultural tractors, is suitable for pulling timber from positions where the ordinary draw-bar pull of the tractor would be insufficient to do the work, and also serves a number of other useful purposes. The Gyro-tiller offers great possibilities in the matter of tree-stump and hedge clearing. When run down hedgerows after the larger trees and bushes have been removed it will lift out bodily all the remaining roots. (3) Explosives provide a rapid, cheap and convenient method of clearing large tree stumps, but are of particular value when used in conjunction with a tractor or horses for clearing hedges and filling in ditches. (4) Chemical methods. Burning by means of setting alight oil, petrol or pitch introduced into holes bored in tree trunks is an uncertain method and is not recommended. Claims made for the use of corrosive chemicals such as nitric and sulphuric acids, caustic soda and potassium chloride also do not appear to be well founded. In each of the methods mentioned above the procedure to be followed is described and the text is illustrated with a number of diagrams and photographs.

SMALL FRUITS, VINES, NUTS.

40. BROWN, W. S.

631.67 : 634.7

Influences of irrigation upon important small fruits.*Sta. Bull. Ore. agric. Exp. Sta.* **347**, 1936, pp. 37, bibl. 4 in text.

An experiment, covering the 10-year period 1926-35, was made in the Willamette Valley, Oregon, to determine the practicability of irrigating small fruits under local soil and climatic conditions. The results obtained in the first five years were published in 1931 in *Bull. Ore. agric. Exp. Sta.*, 277, and a short separate report on results obtained in the second 5-year period has also been issued elsewhere (see *H.A.*, 1936, 6 : 4 : 710). The present paper covers the whole 10-year period. The arrangement of the plots, the irrigation equipment and the method of applying the water are described. The soils used were loam or sandy loam. The summer rainfall for the five months April to August averaged 5.25 inches for the first 5-year period and 4.86 for the second, both figures being below the normal average for the district. July and August together contributed only about 0.5 inch of these totals. Temperatures during the same period were slightly above normal. Under these conditions it was found that applications of irrigation water at depths of 18 to 24 inches appear to be desirable for bramble fruits, but that strawberries, owing to earlier fruiting, require slightly smaller amounts. During the first five years prices were satisfactory and increased yields from irrigated small fruits showed increased profits. During the second five years, however, prices were often below production costs and the larger yields due to irrigation were frequently associated with increased losses. Results obtained with blackberries, loganberries and strawberries may be summarized as follows :—*Evergreen blackberries*. Irrigation increased yields by an average of 36.3%. Irrigated fruits ripened somewhat earlier, and in dry summers were larger and of better quality than unirrigated fruits. Irrigated fruits had slightly lower acid and sugar contents, but the difference was not discernible to the taste. "Drip" tests made on blackberries canned in water indicated no material difference in breakdown between irrigated and unirrigated fruits. Irrigation resulted in the highest average net profit per acre (\$120.76) during the first 3-year bearing period, but also contributed to the greatest average loss (\$104.50) during the succeeding 5-year period. It is concluded that evergreen blackberries, both irrigated and unirrigated, may be produced profitably in the locality when yields are kept high and the prices received lie between 3½ and 4 cents per lb. *Loganberries*. In the case of canes pruned back to 6 feet with all strong canes allowed to remain, irrigation appears to be unprofitable. On the other hand, with canes left full length and all strong canes and laterals remaining irrigated loganberries averaged 36% larger yield than did irrigated short-pruned loganberries, while yields from irrigated plots were on an average 58.4% higher than from unirrigated plots. Irrigation increased the size of fruit only in dry years; it did not alter the acid and sugar contents of the fruit; it slightly reduced the percentage solids in canned fruits, though not to an extent to detract from the appearance of the product. The colour and brightness of fresh fruit was improved by irrigation. In 1929 and 1931, when the price received was about 5 cents a lb., irrigation more than doubled the net income. During the four years 1932 to 1935, however, prices were low and irrigated plots showed greater net losses than unirrigated in three of the years. It is concluded that loganberries may be grown at a profit in the district when prices range from 4 to 4½ cents per lb. *Strawberries*. Irrigation increased yields by 91.5%, delayed fruit maturity slightly, increased the size of fruit by 25 to 100% depending on the season, and markedly improved quality. Irrigation reduced sugar slightly in the Marshall and Corvallis varieties, but had the reverse effect on the Narcissa variety. There were no appreciable differences in the acid contents of fresh, nor in the total solids of canned, fruits. With exception of Ettersburg 121, all the varieties tested showed increased profits from irrigation in each year.

41. COLBY, A. S.

631.67 : 634.7

Small fruit irrigation.*News Lett. Ill. St. hort. Soc.*, 1936, No. 8 : 1-3.

The benefits derived from irrigating small fruits in dry seasons are noted very briefly. During the first growing season, when the plants are not allowed to fruit, a uniformly sufficient supply

of water encourages the formation of a greater leaf area, heavier plant crowns and more and better fruit buds. During fruiting seasons lack of adequate moisture reduces yields and quality. A Minnesota grower has reported that raspberry fruits would "slip off the core without crumbling" when irrigated in dry seasons. The cost of irrigation must, however, be considered. It has been shown that the strawberry crop, for example, must be increased in value by at least \$50 per acre, if most forms of irrigation are to be profitable. Mention is made of overhead and surface irrigation, and in connexion with the latter it is noted that an Illinois raspberry grower has obtained satisfactory results from the canvas hose method.

42. COLBY, A. S. 634.75
Strawberry culture in Illinois.

Circ. Ill. agric. Exp. Sta., 453, 1936, pp. 52, bibl. in text.

Sites, soils and their preparation, planting, cultural practices, manuring, marketing problems, yields, costs and profits and the control of common pests and diseases are considered. Short descriptions are given of the varieties Aberdeen, Aroma, Blakemore, Chesapeake, Dorsett, Fairfax, Dunlap, Premier, and everbearing types such as Mastodon. A few points of interest may be noted here. Setting the plants in spaced rows is considered preferable to growing them in matted rows or on the hill system. Irrigation is needed during dry periods, and methods of overhead and surface irrigation are outlined. Among the latter, irrigation by means of a canvas hose is considered to be promising. The hose may be made at home for a total cost of not more than 9 cents a foot. Mulching late in the autumn with straw, hay, leaves or pine needles is advocated as a means of protecting the plants from the effects of intermittent freezing and thawing and from the drying influence of winter winds. The mulch should cover the plants to a depth of about 2 inches and should usually be left until the plants renew growth.

43. SWARBRICK, T. 634.75 : 581.162.3
The interplanting of Oberschlesien and Tardive de Leopold strawberries with pollinator varieties.

J. Minist. Agric. Lond., 1936, 43 : 650-2.

The falling off noticed in the cropping of Oberschlesien and Tardive de Leopold is found to be due largely to lack of pollination. It has been found that Oberschlesien is not a satisfactory interplant for Tardive. Moreover Oberschlesien, being itself partially self-sterile, should not be planted as a single variety, but provision should be made for its pollination. Royal Sovereign and Huxley have proved satisfactory for both the above varieties and there are indications that Madame Lefebvre is also satisfactory as a pollinator for Tardive. The author considers that the variety to be pollinated should be flanked on both sides by a pollinator variety.

44. STEVENS, C. D. 634.76
The cranberry industry in Massachusetts.

Bull. Mass. agric. Exp. Sta., 332, 1936, pp. 36.

During the past 20 years Massachusetts has produced about 64% of the entire cranberry crop of the U.S. It is the leading export crop of the State, and in recent years the total income derived from cranberry production has been exceeded only by that of the dairying, poultry raising and vegetable growing. This bulletin reports the results of a survey of the industry carried out in 1934 and compares them with the results of the last general survey made in 1924 and in some cases with statistics obtained many years earlier. The report covers cranberry bog acreages, both actual and potential; size of holdings; flowage, i.e. whether the bogs are not flooded at any season, flooded once during the winter, flooded once in winter and once or twice in the spring, or are in a position to be flooded at any time; pumping plants, whether electric or petrol; cranberry varieties grown; production; frost injury; marketing and prices; insecticides used; and lastly labour employed.

45. JARRY-DESLOGES, R. 588.427

La culture du *Passiflora mollissima*. (Growing *P. mollissima*.)

Rev. Bot. appl., 1936, 16: 141-3.

Passiflora (*Tacsonia*) *mollissima* is a plant which, unlike the other *Passiflorae*, will produce fruit in commercial quantities in the climate of the French Riviera. The fruit has a less powerful aroma than the commonly grown *P. edulis* (Granadilla) and should prove extremely marketable. Whereas *P. edulis* ripens when fruit is plentiful in summer, *P. mollissima* is ripe in April-May. It is raised from seed and planted out in pockets of good compost made in a poor calcareous soil. For some weeks the young plant will require heavy shading and watering. It will withstand several degrees of frost when established. The growth is luxuriant and a single plant will produce its very beautiful flowers and long banana-shaped fruits in hundreds. Fruit for transport should be picked as soon as it begins to yellow. Packing should be done with care, if the journey is to be a long one.

46. BOUFFARD, E. 634.8

Les principaux cépages turcs exploités actuellement avec profit. (The principal grape varieties grown commercially in Turkey.)

Progr. agric. vitic., 1936, 105: 419-24 and 563-5, and 1936, 106: 35-8.

The principal white grape varieties grown in Turkey are Sultanina, Razaké, Tchaouch and Yapincak. The two most important red varieties are Karalahna and Papascarassé. The Sultanina plant and fruit, its cultivation and the local method of drying the crop are described in some detail. Yield and export figures for Turkey and some other countries are tabulated, and analyses of fruits obtained in Smyrna, Greece and California are quoted. As a variety for drying the Sultanina possesses exceptional qualities, and in tests white wines made from it have also possessed excellent bouquet and colour, but it is not a good table grape. The other varieties are described in less detail. Razaké is exported primarily as a table grape and only a small quantity is dried. It is not used for wine in Turkey, and tests have shown it to be inferior for the purpose. Tchaouch is the most esteemed table grape in Turkey and Bulgaria, but the plant is rather delicate and does not fruit freely under many conditions. Wine made from it has lacked bouquet and body. The drought-resistant Yapincak is the variety most commonly sold in the market at Istamboul, and is also a good wine grape. Karalahna and Papascarassé are grown only for wine production.

47. MATTRAS, H. 634.8-1.541.44

Expériences de surgreffage de la vigne dans le Gard. (Top-working grape vines in the district of le Gard.)

Progr. agric. vitic., 1936, 105: 200-2.

The bad state of the wine industry in France has recently emphasized the need for growing only the better quality grape varieties. Where unsatisfactory varieties are being grown, top-working offers a means of introducing improved types with a loss of only 1-2 crops, whereas grubbing and replanting result in losses of at least 2-3 crops. Between 1 and 10 April, 1935, in the district of le Gard, plants of Seibel 6305 and Couderc Nos. 2, 8, 10, 11, 14 and 15, worked on Rupestris du Lot 3-4 years previously, were top-worked with Grenaches. The plants were deheaded 24 hours before grafting to allow excess sap to exude. Over 90% of the grafts united and by the end of September the plants showed exceptional vigour. By contrast some other grafts of Grenaches worked direct on 2-year-old Rupestris grew weakly. Top-working makes it possible to study the effects of different intermediates, and as an example in the present case it is noted that Grenaches did better on Couderc No. 15 than on Couderc No. 2.

48. EMON, J. 634.8-1.541.11

Adaptation des porte-greffes aux différents terrains. (The adaptability of grape rootstocks to different soils.)

Progr. agric. vitic., 1936, 106: 521-4.

The adaptability to different soils of about 20 of the more important French grape rootstocks is briefly discussed with notes in the majority of cases on the vigour of the stocks and their

resistance to chlorosis. Resistance to other diseases and to drought is also mentioned in a few cases. In summarizing the author classifies Riparia as a stock for rich deep soils. Rupestris, the most widely used stock, should be replaced in dry soils by 44-53, a Cordifolia × Rupestris hybrid, by 150-15, an Aramon × Rupestris × Berlandieri hybrid, or by Rupestris × Berlandieri hybrids such as 99 and 110. In addition 196-17, a 1203 × Riparia-Gloire hybrid, is more vigorous than Rupestris. The Riparia × Berlandieri hybrids, 420-A and 161-49, are recommended as the most suitable stocks for argillo-siliceous and calcareous-siliceous soils, while the Rupestris × Berlandieri hybrids 99 and 110, the Aramon × Rupestris × Berlandieri hybrid 150-15, the Franco × Berlandieri hybrid 333 and the Colomba × Berlandieri hybrids are to be preferred on argillo-calcareous soils.

49. BELTRAN, E., AND OTHERS. 634.8 : 581.192
 Étude physico-chimique de la sève élémentaire de la vigne. (Physico-chemical study of the natural sap of grape vines.)
C.R. Acad. Agric. Fr., 1936, 22 : 52-4.

Sap was obtained at the end of March from freshly cut branches of five common grape varieties growing under homogeneous soil conditions. The plants were all grafted on the same clonal rootstock, 420A, and were 12 years old. Neutralization curves were determined and from these buffer coefficient curves were obtained. In all the varieties studied the buffering coefficient curve showed a peak lying between pH 6 and pH 8 and mostly between pH 7.1 and pH 7.5, with a mean of pH 7.4. It is recalled that the pH range of 7.1 to 7.5 is also acknowledged to provide the optimum soil reaction for the cultivation of vines, and from this the authors suggest that a study of the neutralization curves of the sap may provide a means of discovering the most suitable reaction for a cultural medium destined to support any particular plant. With such a pH equilibrium between the soil and the plant sap, the plant would be able to exert the highest buffering effect. Of the individual varieties, four, namely Carignan, Clairette, Cinsault and Cot de Chérags, produced buffering coefficient curves with a number of important peaks within the range mentioned, but the fifth variety, Kabyle, also showed peaks in the region of pH 5.2, thereby demonstrating affinity with plants from mountainous regions. The authors consider that a systematic study of neutralization curves taken in conjunction with a study they are making on oxidation-reduction potentials should yield interesting results.

50. LAGATU, H., AND MAUME, L. 634.8 : 551.54 : 631.8
 Dans quelle mesure les variations atmosphériques peuvent-elles, sous le climat méditerranéen, modifier chez une vigne les rapports physiologiques et les quantités absorbées d'azote, d'acide phosphorique et de potasse ? (To what extent do variations in weather modify physiological relations in, and the quantities of N, P₂O₅, and K₂O absorbed by a vine growing under Mediterranean climatic conditions ?)
C.R. Acad. Agric. Fr., 1936, 22 : 363-82, and *Progr. agric. vitic.*, 1936, 106 : 89-92, 115-20 and 280-4.

A level area of stony, non-calcareous land on a hill-side south of Montpellier was selected for a vine manurial trial started in 1920. The grape variety was Aramon grafted on Rupestris. In the present paper comparisons are made between an unmanured plot and a plot receiving annually, except in 1928, the last year of the experiment, a full fertilizer treatment consisting of N 80, P₂O₅ 75 and K₂O 90 kg. per hectare. At first only yield records were taken, but from 1923 onwards leaf analyses were made monthly on samples consisting of the two lower leaves from the base of fruiting branches, in order to determine the total NPK content expressed as a percentage of the dry matter and also the balance existing between N, P and K. As regards total yields, the crops in two years were ruined by hail and drought respectively. Yield records per 100 vines for the other six years showed very marked variations, and indicated that, although

manuring gave increased yields, it was climatic conditions which exerted the dominant influence upon the yield in any given year. Thus in 1924, for example, the control plants produced greater yields than did the manured plants in four out of the other five years, while in the same year the yield from the manured plants was greatly in excess of the yield in any other year. Similarly it is shown from the leaf analyses that the manure was not the dominant factor determining variation in the percentage of N+P+K present in the leaves. As with yields the control plants in 1924 showed a higher percentage N+P+K than did the manured plants in four other years. The balance between N, P and K likewise varied greatly from year to year, although within each year trilinear graphs for the control and manured plants showed marked similarity. The manured plants in 1924, which gave the highest yield of any year, are held to have possessed the optimum balance, namely N 41%, P_2O_5 8% and K_2O 51%. By contrast, the control plants in the same year showed an N : P_2O_5 : K_2O balance of 55.21 : 11.44 : 33.35, indicating a relative soil deficiency in potassium. The general conclusions reached are:— (1) Under Mediterranean conditions the yield of vines, the proportion of NPK present in the dry matter of the leaves, and the balance between N, P and K are all primarily dependent upon the climatic conditions in each year. (2) This dependence upon atmospheric variations has been found in other plants besides the vine. (3) Further observations are necessary. (4) The preliminary results indicate that a vine receiving a manure containing almost equal quantities of N, P and K does not absorb these constituents in like proportion, nor after several years does there appear to be any cumulative effect in this respect.

51. HERSCHLER, A. 634.8-2.19-1.8
 Ernährungsstörungen an Reben durch Bodenverhältnisse mit besonderer
 Berücksichtigung von Kalimangelschäden. (**Nutritional disturbances in vines
 due to soil conditions, with particular reference to K deficiency.**)
Ernähr. Pfl., 1936, 32 : 197-204, bibl. 15.

A survey of the particular regions in the Moselle, Saar and Ruwer districts, where the growth of vines had been noticeably poor in certain respects, by the Biologische Reichsanstalt enabled the following conclusions to be drawn. The soils were found to be either slightly or markedly acid and to be deficient in one or more nutrients. Especially in the sandy soils of the lower and middle diluvial terraces overlying a sticky subsoil two types of symptoms could be observed. (1) From June onwards brown discolorations of the leaves were seen and these developed into a scorch of one-third of the leaf surface by September. Also gaps could be seen in the bunches due to grapes not filling out, and early defoliation occurred. Several years of these symptoms were followed by decreased yield and wood growth. They are attributed to lack of phosphates. (2) Under similar soil conditions quite different, chlorotic and mosaic discolorations could be seen in June and July. They also led to partial scorch of the leaf margin. The leaves, however, in this case showed normal nutritional conditions. The first buds fell off during or immediately after blossoming. From July to August onwards, bluish, shrivelled berries could be seen in the grape bunches of affected vines. After two years a drop in yield and in wood growth was noticeable. Although these symptoms indicate magnesium deficiency, it has as yet not been possible to confirm this. It is suggested that, where any of the above symptoms are strongly developed, very thorough soil treatment is essential, namely complete farmyard manuring with the addition of burnt lime and superphosphate. Moreover, especially where the magnesium deficiency (?) symptoms occur, calcium cyanamide and potash magnesia can be recommended. A further set of symptoms were noticeable on less acid to neutral soils, often in new plantings. Here from the middle of July onwards small brownish red spots appeared on the leaves, which later shrivelled at the edge and tended to roll up. In September the berries in the grape bunches were still small and wood growth was weak. The potash content of the leaves was low and the symptoms were undoubtedly due to potash deficiency. Two applications of 180 lb. of K_2O , as muriate, per 1,200 sq. yards on sandy loams with gravelly subsoils sufficed to remove the symptoms almost entirely in a year, and on deep diluvial loam soils within 2 or 3 years.

52. VINET, E. 631.83 : 634.8
 Action de la fumure potassique sur la vigueur générale de la vigne. (**The influence of potassium fertilizers on the growth development of vines.**)
C.R. Acad. Agric. Fr., 1936, 22 : 893-900, and *Progr. agric. vitic.*, 1937, 107 : 20-3, bibl. 2 in text.

The arrangement of the plots and treatments in this fertilizer experiment has been described in earlier papers.* The treatments consisted of two control plots receiving no manure; four plots receiving equal amounts of N and P_2O_5 but different amounts of K_2O , and a plot receiving N and P_2O_5 but no K_2O . The fertilizers were applied annually over a 5-year period up to 1932 when the vines were 10 years old, but thereafter no further manure was applied. The present report is concerned primarily with the effects of K_2O on the development of the vines in the years following the cessation of manuring. In previous reports an estimation of the annual growth of the plants was obtained by shoot measurements and from the weight of prunings. In the present case it was desired to indicate the acquired vigour of the whole plants and through this obtain a measure of their general growth as affected by the manure. To do this a system of allotting marks was adopted in 1935, based on stem and branch diameters, the number and length of the shoots and the length of the internodes following leaf fall. Theoretically each plant might receive from 0 to 10 marks for general vigour, but in practice the marks allotted range from 2 to 9. Results are expressed as percentage increases over the mean number of marks received by the two control plots. The effects of the different treatments as indicated by this method were found to be in very similar proportions to those indicated by annual growth measurements in the three preceding years. The plot which had received no K_2O showed the smallest increase in vigour over the controls, and the K_2O -fertilized plots showed increments in direct proportion to the amount of K_2O applied. Moreover the yield, as indicated by sugar production, from the plots which had received K_2O showed considerably greater mean increases (83.7%) over the controls than did vigour (35.2%). By comparison, the plot which had received no K_2O gave a lower yield of sugar than did the controls, indicating that a vine which increases in vigour does not necessarily also increase in productivity. Wood analyses made in conjunction with the field records revealed that these vines possessed a lower K_2O content and P_2O_5 :N ratio than did the control plants, and the author suggests that this lack of nutrient balance may be the primary cause of a form of chlorosis observed in the plants which had received N and P_2O_5 but no K_2O . The form of K_2O used in three of the plots was chloride and in the fourth sulphate, and it is noted that both in the years when manuring was in progress and after it had ceased the sulphate gave superior results as regards the quality of the growth response, although there was no difference between the increments of general vigour.

53. LAGATU, H., AND MAUME, L. 634.8-1.8
 Vigne et apports calciques. (**The effect of adding lime and gypsum to an NPK fertilizer on vines growing in non-calcareous soil.**)
C.R. Acad. Agric. Fr., 1936, 22 : 478-94.

The experiment on the effect on grape vines of a complete NPK fertilizer (noted above in abstract 50) was carried out in a soil and subsoil which, although not definitely acid, gave no trace of effervescence when a strong acid was added. The action of lime when applied with the same amount of NPK fertilizer was studied in three additional plots in the same experiment and the results are here reported. The first of these plots received annually 800 kg. lime per hectare (=732 lb. per acre), the second 800 kg. of lime + magnesia and the third 800 kg. of gypsum. The treatments were applied from 1921 to 1927 inclusive, and no fertilizers were given in 1928. Records from 1921 to 1928, excluding 1922 and 1926 when the crops were ruined by hail and drought, indicate that in each year the additions of calcium reduced yields by comparison with those obtained from the NPK fertilizer alone. Leaf analyses made monthly from May to September in 1926, 1927 and 1928 show that neither the NPK fertilizer alone nor with lime produced any significant or consistent increases of calcium in the leaves over the unmanured control plants. In all cases the CaO content of the leaves increased during May and early June,

* *C. R. Acad. Agric. Fr.*, 1935, 21 : 30-41 and 911-9, *H.A.*, 1936, 6 : 1 : 54 and 55.

but in both 1926 and 1927 the plants receiving lime and gypsum showed a sudden decrease in CaO between mid-June and mid-July. This decrease was much less marked or non-existent in the control plants, the plants receiving NPK alone, and in all plants in 1928 when no fertilizers were applied. The conclusion is reached that the addition of calcareous substances to NPK fertilizers made the vines more sensitive to changes in atmospheric conditions which affect the absorption of calcium by the leaves. Differences in the CaO content of the leaves in the three years are likewise attributed to weather conditions, since all plots, whether limed or not, reacted similarly. In 1926 and 1928 the CaO content for the 5 plots ranged from 2.5 to 3.5% of the dry matter, while in 1927 the range was from 3.5 to 4.0%. The rainfall in the 1926-7 season and especially in June and July was considerably higher than that in the seasons preceding and following it. This observation is in agreement with the fact that the extent of chlorosis of vines growing in calcareous soils varies from year to year and is more severe in wet seasons. The addition of magnesia to one of the plots resulted in a reduced CaO : MgO ratio in the leaves by comparison with control plants, whereas the addition of gypsum raised the CaO : MgO ratio. The effect of lime and gypsum upon the total N + P₂O₅ + K₂O content of the leaves was found to be negligible, the content being in general almost identical with that of the plants receiving NPK fertilizer alone. On the other hand there was a tendency in 1926 and 1927 for the lime and gypsum to increase the proportion of K₂O in the leaves at the expense of N. On the cessation of manuring in 1928, however, only the gypsum appeared to exert any residual effect of this nature. It is concluded that the increased proportion of K₂O in the plants due to liming might in some cases have a beneficial effect, but that where the total rate of NPK nutrition is insufficient it exerts no useful influence. These results in general appear to justify local viticulturists in their long-standing indifference to, and even mistrust of, lime as a fertilizer for use on non-calcareous soils.

54. LAGATU, H., AND MAUME, L. 634.8-1.8 : 581.192
 Variations qualitatives et quantitatives de l'alimentation NPK d'une même
 espèce végétale dans un même sol, en dehors de toute intervention d'engrais.
 (Qualitative and quantitative variations in the NPK nutrition of grape vines
 growing in the same soil, not associated with any fertilizer treatment.)
Progr. agric. vitic., 1936, 105 : 353-6.

It has already been demonstrated in trials made at Grammont, near Montpellier, that alterations in climatic conditions are responsible for marked variations from year to year in the NPK nutrition of the grape leaves situated at the base of fruiting branches (see abstract 50). The object of the present paper is to show that similar variations may be produced by different methods of cultivation. The vine was Aramon on Rupestris. Two plots were compared. In the first the vines were left uncultivated and injurious weeds were merely scythed twice, while in the second the soil was tilled in accordance with general viticultural practice. Neither plot was manured. Leaf analyses made on 10 May, 13 June, 17 July and 7 August revealed that, on a basis of previous findings, the plants in both plots were undernourished. On the other hand, on all four dates the total NPK content expressed as a percentage of the dry matter was higher in the cultivated than in the non-cultivated plot. The P₂O₅ content of the cultivated plants was likewise at all times higher and did not decline throughout the season as did that of the non-cultivated plants. The difference in the proportions of P₂O₅ as related to N and K₂O was even more marked, and the leaf analysis of the cultivated plants resembled that of vines receiving a predominantly phosphatic manurial treatment. N in both plots decreased up to 17 July, and continued to do so subsequently in the non-cultivated plot, but in the cultivated plot the analysis on 7 August showed the decline in N to have been arrested and the actual proportion of N in relation to the other constituents to have risen sharply. In amount of K₂O there was little difference between the plots, but the proportion of K₂O was lower at all times in the cultivated plants. It is, therefore, concluded that cultivating the soil produces both quantitative and qualitative differences in the NPK nutrition of vine leaves and that, regardless of any fertilizers which may be applied, variations in NPK nutrition will be produced from year to year by differences in weather conditions and by different cultural practices.

55. MOREAU, L., AND VINET, E. 634.8-1.4+ 1.8
 Sur la vigueur de la vigne dans ses rapports avec le sol, la fumure et quelques
 maladies de la grappe. (*Vigour in the grape-vine in relation to soil, manure
 and certain diseases of the fruit.*)
Ann. agron., Paris, 1936, 6 : 542-58, bibl. 6.

A definition of what is meant by vigour is given and a distinction drawn between *acquired vigour* shown by the development of the old wood, trunk, frame branches and large roots, and *annual vigour* shown in the new growths. Naturally, they are interdependent and the combined result is termed *vigour in general*. This may be satisfactory and result in good crops, or it may be detrimental to fruit production according to the factors, permanent or transitory, which have influenced the annual and, through it, the acquired vigour. The method of evaluation for the purposes of experiment of the different types of vigour is described. The experimental plots were on hillsides in a clay-silica soil, the upper part of the slope being of a poorer nature than the lower, conditions which were reflected in the differences in vigour of the unmanured control vines on the upper and lower slopes. From 1928-32 except for the totally unmanured controls the experimental plots had each received per hectare 150 kg. sulphate of ammonia and 400 kg. of superphosphate 16%. Potash treatments differed with each plot and were 900, 600, 300 kg. potassium chloride, 625 kg. potassium sulphate and no potassic manure. The results achieved are all tabulated but, speaking generally, it was found that in 1935, though increased vigour was obtained in both soils, the manures had exerted the greatest influence in the poorer soil, reducing materially the differences in percentage of vigour between them. Vigour of the plant and the sugar content of the fruit increased with the amount of potash applied and was much reduced in the plots deprived of it. The yield also increased proportionately with the amount of potash until 1935, when exactly the reverse occurred except on the non-potash plots whose relative yield remained unchanged. The loss of crop was caused by fruit-drop, mildew and *Oidium*, which were prevalent throughout the district this year, besides which the experimental orchard had been insufficiently sprayed this season. *Fruit drop*. On the unmanured soil amount of fruit drop could be positively correlated with degree of vigour. On the manured ground, however, fruit drop was considerably less on the rich lower part containing the more vigorous vines, which had responded less to the treatments than on the poor upper slopes, where the vines had responded relatively more vigorously to the manure. There must, then, be a point in the vigour drawn from manures below which fruit drop is diminished and above which it is increased, and the position of this point, as follows from the results, must vary for any one manurial formula with the nature of the soil and the degree of natural vigour of the vine. *Mildew* and *Oidium*. These diseases are always favoured by vigour in the vine whether derived from the soil or manurial treatments, but while mildew develops in a consistent relation to vigour irrespective of the situation of the vineyard, *Oidium* is sensitive to environment and to the ambient conditions of atmosphere created by its degree of growth. The only treatment in which the manure appeared to influence directly (in this case to hinder) the development of these two diseases was the non-potash one, but it provided instead a low yield and a number of physiological troubles.

56. JERNA, G. 634.8-1.542.14
 Il diradamento chimico degli acini dell' uva. (*Thinning grapes by chemical
 methods.*)
Ortofrutticoltura ital., 1936, 5 : 117-9.

Thinning table grapes by removal of bunches and berries is a matter of common practice but is a costly one. The grape's normal flowering period is a week with a minimum intensity in the first and last days of the period and a maximum on the third day, the intensity being the same at any given time for all parts of the bunch. Palieri at Maccarese, near Rome, tried the effect of spraying the bunches 3 or 4 times during the flowering period with a chemical solution [formula not given—ED.*] in the hope that the flowers which were open at the time would,

* Actually a proprietary article called Diraduva (=grape thinner).

whether fertilized or not, become abortive and fall off and that the unopened flowers would be unaffected. It is claimed that his success was complete. Not only was this chemical thinning uniformly distributed, but it proved very much cheaper than thinning by hand. The following advantages are claimed :—Greater uniformity of grapes in the bunch ; increased length of the main stem of the bunch ; increased length of the peduncles of individual grapes as a result of the atrophy of those destroyed ; slightly earlier ripening ; increased size of individual grapes and hence of bunches.

57. DOTTI, F. 634.8-1.542

Influenza della potatura della chioma e della radice prima del trapianto sulla sviluppo della vite. (Influence of top and root pruning before transplanting on the growth of vines.)

Published by Cattedra ambulante d'agricoltura della Provincia di Ravenna, 1936, pp. 26, bibl. 27.

In 1934 the author published a paper on the effects of top and root pruning various fruit trees (*Romagna agricola*, November-December, 1934 ; *H.A.*, 1935, 5:4:560). Since then he has experimented in the same way with grape vines, actually with 384 1-year rooted cuttings of *Riparia* × *Rupestris* 101-14, and has noted carefully the result on the first year's growth of 4 methods of pruning. These were :—(1) no pruning of top or roots ; (2) drastic pruning of head, i.e. removal of all shoots except one and shortening of this to 3 buds, the roots remaining untouched ; (3) drastic pruning of head as above and of roots, in this case all roots arising on or intermediate to the nodes were removed and those arising from the end of the cutting were shortened to 3 cm. ; (4) no pruning of top, drastic pruning of roots. The resulting growth was noted and is here fully tabulated. The author concludes :—The vines with unpruned roots started into growth earlier than those with pruned roots. There was no failure to grow in any case. The greatest increase in growth was found in the group of vines which were left unpruned. The most harmful effect on growth was achieved by drastic root pruning. Top pruning, even without root pruning, resulted in a marked decrease in growth. Root pruning alone did more harm than pruning both top and roots. Results do not agree with common practice but bear out conclusions drawn from previous work by the author and others.

58. ROY, H. 634.51-1.541.11

Porte-greffes du noyer dans l'Isère. (Rootstocks for walnuts in the Isère district.)

Progr. agric. vitic., 1936, 106 : 499-503.

The walnut plantations of Isère consist almost exclusively of the varieties Mayette, Franquette and Parisienne, which, in the case of this district, are often referred to collectively as the Grenoble walnut. As in most areas in which a single crop is cultivated intensively and continuously for many years numerous physiological and pathological troubles have made their appearance. The more serious of these are mentioned with suggestions as to their control, but the main object of the present paper is to discuss the relationship between rootstocks and the "honey" fungus rot (*pourridié*) which is caused by a species belonging to the *Agaricaceae* [possibly *Armillaria mellea*—ED.]. It has been recommended for some time past that in infected soil local varieties should be grafted on the American black walnut, *Juglans nigra*. This species is not immune, but has been shown to be sufficiently resistant for all practical intents and purposes. Thus in one plantation destroyed by the fungus and replanted 30 years ago with trees grafted on black walnut no further destruction has occurred and the trees are now large and with perfect unions. In another case a *nigra* tree was grafted with wood from a tree which had been killed by the fungus and at the same time the soil around it was covered with diseased roots, but the *nigra* tree did not become infected. Similarly in the case of a local variety grafted on *nigra*, but with the graft union planted below soil level, the scion became diseased after 8 years, but the stock remained healthy. Other species of *Juglans*, *Pterocarya* and *Carya* have been tested as resistant rootstocks, but so far *J. nigra* has given the best results. The disadvantage of this species is

that it requires rich deep soils and will not grow well in most of the local walnut soils. Attempts are, therefore, being made to raise resistant hybrids from a cross between *nigra* and a native walnut.

PLANT PROTECTION OF DECIDUOUS FRUITS.*

59. REBOUR, —. 581.144.4 : 634.1/2
Mauvais départ de la végétation des arbres fruitiers en Tunisie. (**Delayed
foliation of fruit trees in Tunis.**)
C.R. Acad. Agric. Fr., 1936, 22 : 752-4.

Following a late autumn, attended by delayed defoliation, an above normal mean winter temperature and an early spring in 1935-6 many fruit trees in Tunis exhibited seriously delayed foliation. In some cases trees had not yet bloomed when the crop should have been ripening; in many others blooming was delayed for 5-6 weeks and bud break was very irregular; and again in others the lower parts of the tree developed normal foliage while the upper parts remained bare. Peaches, in particular, were badly affected. European apple varieties were only starting growth, while local varieties were ripening their fruit. Pears and Japanese plums were better, but varieties of *Prunus domestica* foliated very irregularly. Most cherry varieties were affected, but apricots, with the exception of some French varieties, grew and fruited normally. With figs bud break was somewhat delayed but was uniform, while with quinces, almonds and grapes growth was generally satisfactory. Olive trees, which were not exhausted by the preceding heavy crop, grew normally, but the flowering season was spread over a very long period. Irrigated orchards were not spared. As a result of a study of climatic and growth and cropping conditions during the preceding summer and autumn a number of possible causes were eliminated and it was finally established, with as much certainty as possible, that the cause of the trouble lay in the adverse effect of the high winter temperatures on the dormancy of temperate-zone trees. It was also possible to classify the various species and varieties as "long winter" or "short winter" plants on a basis of their degree of resistance to delayed foliation. An investigation of varieties better suited to the climatic conditions of Tunis is to be undertaken.

60. JOESSEL, P.-H., AND LIDOYNE, A. 634.25-2.191
Essais de traitements contre la chlorose du pêcher. (**Investigations of treat-
ments for chlorosis in peaches.**)
Progr. agric. vitic., 1936, 105 : 329-32.

This paper is the first half of one already published in *C.R. Acad. Agric. Fr.*, 1936, 22 : 306-11, and deals only with the first three treatment methods noted in the abstract of that paper (*H.A.*, 1936, 6 : 4 : 732).

61. VIDAL, J. L. 634.8-2.191
Amélioration du badigeonnage Rassiguier contre la chlorose. (**Painting
pruning wounds with various iron salts to cure chlorosis of grape vines.**)
Progr. agric. vitic., 1936, 106 : 515-6.

Rassiguier's method of painting pruning-wounds with solutions of iron salts was used to compare the effects of a number of iron compounds applied in the autumn to control chlorosis. Grape vines growing in calcareous soil and suffering badly from chlorosis were chosen for the experiment. The results, based on the number of shoots developing, the extent of the yellowing of the foliage and the yield of treated and control plants indicate that, although a 40% iron sulphate solution had a very considerable beneficial effect, certain other materials were superior. Thus, whereas 40% iron sulphate alone increased yields by 30%, 25% iron sulphate + 6% citric acid, 28% neutral ammoniacal iron citrate, and 25% iron sulphate + 6% tartaric acid increased yields by about 66%. It is recalled that similarly successful results have been obtained elsewhere with

* See also 14, 39, 177, 178.

iron sulphate + citric acid and with iron citrate. 50% perchloride of iron + 10% citric acid also gave a slightly better response than did 60% perchloride of iron alone. Iron citrate is more expensive than iron sulphate, but the concentration used is lower and the cost insignificant when compared with the increased returns. It is therefore suggested that, where the wound-painting method is to be used against chlorosis, a 25 to 30% solution of iron sulphate + 5 to 10% citric acid or a 28 to 30% solution of iron citrate should be substituted for a 30 to 40% solution of iron sulphate used alone.

62. ATKINSON, J. D. 634.11-2.19 : 546.27
The control of corky-pit of apples in New Zealand.
N.Z. J. Sci. Tech., 1936, 18 : 381-7, bibl. 7.

The paper deals with the acute corky-pit type of injury prevalent in the Nelson Division in New Zealand and rare elsewhere in the Dominion. It is here distinguished from bitter- or storage-pit, which is frequent in all districts and may or may not be a varying symptom of the same disease. The symptoms of corky pit are brown necrotic areas in core and flesh often causing marked distortion. Premier, Delicious, Washington, Jonathan, Sturmer and Granny Smith trees, 146 in all, treated with boron by injection or soil dressing, remained practically free from pitting, while untreated trees averaged from 87%-59% of pitted fruit. The fact that the season was wet may have influenced the success of the soil dressings in causing the borax to penetrate rapidly to the root area.

63. ASKEW, H. O., AND OTHERS. 634.11-2.19 : 546.27
The use of borax in the control of "internal cork" of apples.
N.Z. J. Sci. Tech., 1936, 18 : 365-80, bibl. 3.

A full abstract of this paper was given in *H.A.*, 1936, 6 : 3 : 466 on its publication as *Publ. Cawthron Inst.* 14 in *J. Pomol.*, 1936, 14 : 227.

64. GILL, N. T. 587.34 : 631.543.82
The hawthorn plant and the selection of "quick" for hedging.
J. Minist. Agric. Lond., 1936, 43 : 460-4.

Crataegus monogyna is the species of hawthorn from which English so-called "quick" hedges are formed. There is a large number of strains within the type and the author divides them into two groups as follows :—(A) The leaves of the long shoots are small and very deeply lobed and often have large leafy stipules at their base. The long twigs usually have spines at least above the lower leaves and often above most of the leaves of the twig. (B) The leaves are much larger and less deeply lobed and the size of the stipules varies considerably or they may be entirely absent. The one-year-old shoots are usually longer than those of (A) and relatively free from spines. Hedges composed of (A) plants are slower growing and less vigorous than those composed of (B) plants. Hence (B) plants should always be selected for hedging in preference to (A). There are within the group further obvious subdivisions, but these have not been worked out as yet. It may be possible to find characteristics which will point to suitability for planting under particular soil or climatic conditions.

65. EASTHAM, J. W. 632.3/4 + 632.952
Diseases of cultivated plants in British Columbia, and their control.
 Hoy, B.
Sprays and spraying.
Hort. Circ. Dep. Agric. B.C., 73, 1936, pp. 1-69 and 71-84.

The first author contributes the section on the plant diseases and their control, and notes that, with the exception of a few of the more definite non-parasitic diseases such as water-core and bitter-pit, the diseases described are mainly those caused by fungi and bacteria. Immunity and resistance, and general methods of prevention are discussed briefly. Notes on the following diseases of horticultural crops are given together with recommendations for their control :—Apple : Anthracnose (*Neofabraea malicorticis*), crown-gall (*Pseudomonas tumefaciens*), scab

(*Venturia inaequalis*), fire-blight (*Bacillus amylovorus*), perennial canker (*Gloeosporium perennans*), crown-rot, drought-spot, blister, bitter-pit, water-core, breakdown, scald and silver-leaf (due to *Stereum purpureum* and other causes). Apricot: *Coryneum* blight. Blackberry: Sun-scald of fruits. Cherry: Brown-rot (*Sclerotinia* sp.), blossom-blight, gummosis, leaf-spot or shot-hole (*Coccomyces* sp.), and black-knot (*Dibotryon morbosum*). Currants and gooseberries: Powdery mildew (*Sphaerotheca mors-uvae*), and blister-rust (*Cronartium ribicola*). Peach: Brown-rot (*Sclerotinia americana*), leaf-curl (*Exoascus deformans*) and powdery mildew (*Sphaerotheca pannosa*). Pear: Scab (*Venturia pirina*). Plum: Brown-rot (*Sclerotinia americana*). Quince: Fire-blight, and black-spot (*Fabraea maculata*). Raspberry: Anthracnose (*Plectodiscella veneta*, *Gloeosporium venetum*), yellow rust (*Phragmidium Rubi-Idaei*), orange rust (*Gymnocomia interstitialis*), cane-blight (*Leptosphaeria coniothyrium*) and mosaic. Strawberry: leaf-spot (*Mycosphaerella Fragariae*), and leaf-scorch (*Diplocarpon Earliana*). Tomato: Blossom-end or point rot, leaf-mould (*Cladosporium fulvum*), stripe, black stripe or streak, and mosaic and yellows. Celery: Late blight (*Septoria Apii*), heart-rot, and "rust". Cruciferous plants: Club-root (*Plasmodiophora Brassicae*). Onion: Downy mildew (*Peronospora schleideni*). Hollyhock: Rust (*Puccinia Malvacearum*). Rose: Powdery mildew (*Sphaerotheca pannosa* and *S. Humuli*), rust (*Phragmidium subcorticinum*) and leaf-blotch (*Diplocarpon Rosae*). Diseases of cereals and other agricultural crops are also described, but potato diseases form the subject of a separate publication. The section on sprays and spraying gives directions for preparing a fairly large number of stomach poison and contact insecticides, fungicides and disinfectants. Some general notes on rodent-control, spreaders, spraying machinery, winter and summer spraying and costs are included.

66. GOIDANICH, G. 632.8 : 634.2
 La leptonecrosi* degli alberi da frutta ed il comportamento di alcune varietà americane. (**Leptonecrosis of fruit trees and the behaviour of certain American varieties.**)
Ital. agric., 1936, 73 : 459-64.

The author recounts the incidence of a non-parasitic disease found chiefly on American varieties of apricots and peaches introduced into Italy and on *Prunus salicina* (*triflora*) (Japanese plum varieties) in Italy. The trouble is characterized chiefly by a breakdown of the circulatory apparatus of the plant which develops into complete necrosis and results in death. It has not as yet been seen in *Prunus domestica* varieties. Most of the Japanese plums in Italy are, moreover, worked on *Prunus mirobalana*, and it is found that this stock is entirely free from attack even when grafted with varieties which become affected. The symptoms have not apparently been reported on Japanese plums growing in America according to the author, but it seems likely that they may be the same as those described in France on more than one occasion under the name of "Apoplexie". Neither climate nor soil would appear to be the cause, so diverse are the soil and climatic conditions under which the symptoms have been noted in Italy. Possibly incompatibility may be at least a predisposing agent, though there are indications that it is not the ultimate cause. There is no trace of harmful bacteria or of any kind of fungus which can be made responsible, and the author is led to suppose that possibly a virus is the cause. He has, therefore, started injection experiments, inoculating the phloem of healthy trees with juice extracted from affected trees. Results to date are inconclusive, but he hopes to report again in 1937.

67. BERKELEY, G. H. 634.22-2.1/4
Studies in fruit diseases. II. Diseases of plums and their control.
Publ. Canad. Dep. Agric., 532,† being *Circ.* 114, 1936, pp. 10, bibl. 2.

The symptoms of, and injury caused by, the following plum diseases are described:—Black knot (*Dibotryon morbosum*), brown rot (*Sclerotinia fructicola*), plum pockets (*Taphrina Pruni*), shot hole or leaf spot (*Coccomyces prunophorae*), silver leaf (*Stereum purpureum*), bacterial leaf

* =the necrosis or death of the phloem-like portion of the vascular bundles.

† Being revision of *Pamphl.* 119—Diseases of plums and their control.

spot or shot hole (*Bacterium Pruni*) and little plum (a virus disease). Recommended control measures are given in each case. In addition sections are devoted to winter injury, factors promoting its occurrence, and its prevention and treatment, and to a spray schedule for plums.

68. HOCKEY, J. F.

Studies in fruit diseases. IX. Apple scab.

634.11-2.42

Publ. Canad. Dep. Agric., 519,* being *Circ.* 109, 1936, pp. 8.

The symptoms of the disease and the life history of the causal fungus, *Venturia inaequalis*, are described briefly. The two main sources of infection are ascospores from the old leaves and summer spores from the current season's spots. No satisfactory commercial method has yet been evolved for treating old leaves to prevent winter spore formation, although ploughing under and burning them are of some assistance. Where scab is a serious disease, preventive spray applications are made at the following growth stages:—(1) The "delayed dormant", "green tip", or "mouse ear" stage, (2) the "pre-pink", "cluster bud" or "closed cluster" stage, (3) the "pink" or "open cluster" stage; and following blossom fall, (4) the "calyx" stage, (5) the "small apple" spray 10-14 days after the calyx spray, and (6) the "second cover" spray 3-4 weeks after the calyx spray. In some districts some of these applications may be omitted, while in others, in seasons favourable to the disease, further cover sprays may be necessary. Notes are supplied on the spray materials which may be used. Lime sulphur is satisfactory except under conditions which prevent it from drying within half an hour of application or in hot humid weather when it may cause foliage injury, russetting and dropping of fruits. Bordeaux mixture should also be applied when it will dry quickly so as to avoid severe foliage injury, and should not be used in "pink" or "calyx" applications when it causes russetting of the fruit. Iron sulphate-lime sulphur mixture is used extensively in the Maritime provinces and may be applied to wet foliage without risk of injury. Combinations of wettable sulphurs and lime sulphur are also recommended in some districts to minimize the danger of lime-sulphur burning.

69. SCHMIDT, M.

632.42 : 634.11

Venturia inaequalis (Cooke) Aderhold. VI. Zur Frage nach dem Vorkommen physiologisch spezialisierter Rassen beim Erreger des Apfelschorfes. Erste Mitteilung. **(The occurrence of physiologically specialized strains of the apple scab fungus. 1st report.)**

Gartenbauwiss., 1936, 10 : 478-99, bibl. 15.

Inoculation experiments were carried out with *Venturia inaequalis* on apple varieties and other *Malus* species. Single spore cultures, isolated from different apple varieties and other *Malus* species and morphologically differentiated by growth on artificial media, were used. Inoculations were made almost entirely on varieties which had shown themselves susceptible in the orchard. A fungus strain isolated from one particular variety was found to attack not only that but other varieties as well, and it is thus possible to inoculate one host successfully with a large number of single spore strains. The strains isolated from 14 apple varieties were inoculated into each of the other 13 varieties. Most of them had pathogenic effects on some varieties but not on others. No one strain showed exactly the same pathogenic effect on all the varieties as another. The specific virulence of the strains of different origins could thus be characterized by the help of the 14 varieties. Results of infection with single spore cultures originating from various apple districts agreed in general with those obtained by using material from Müncheberg. Ernst Bosch and Antonovka were found to be resistant to a relatively large proportion of the strains used. When the pathogenic effect of a strain on certain apple varieties or other *Malus* species was small, chlorotic spots, often with a brown, necrotic centre, occurred containing few, if any, conidia. Morphologically different strains isolated from one tree varied in their virulence to particular hosts. Strains isolated from cultivated apple varieties could infect *Malus* spp. and vice versa. These experiments prove that single spore strains of *V. inaequalis* show specialized forms in their choice of host. [Author's summary.]

* Being revision of *Pamphl.* 82.

70. RICHTER, H. 632.48 : 634.11
Fruchtfäule durch den Erreger des Obstbaumkrebses (*Nectria galligena* Bres.).
(Fruit rot caused by the organism responsible for apple canker.)
Angew. Bot., 1936, 18 : 477-81, bibl. 11.

This is a note of the first observed appearance of the perithecial stage of *Nectria galligena*, viz. *Cylindrocarpon Mali* (All.) Wr., syn. *Fusarium Mali* Allescher on growing apples in Germany. An examination of the literature on the subject shows that damage is generally slight, one of the worst attacks being reported from England by Dillon Weston in 1925. In this 25% of a crop of some 5 tons of Worcester Pearmain was rendered unsaleable by it. It is not thought that special measures are necessary to deal with it provided ordinary precautions are taken to control canker, scab and brown rot.

71. ZELLER, S. M. 634.7-2.48
Verticillium wilt on cane fruits.
Sta. Bull. Ore. agric. Exp. Sta., 344, 1936, pp. 25, bibl. 7 in text.

Verticillium wilt of brambles, caused by *V. albo-atrum*, is a serious disease in Western Oregon and has contributed largely to the discontinuation of black raspberry growing in certain districts. The symptoms of the disease and the results of inoculation experiments are here described. As regards varietal susceptibility, all black and purple raspberries tested were found to be susceptible although some lived for several years after being infected. Among red raspberries Cuthbert proved to be very resistant, but Ranere, Chief, Herbert, Red Antwerp, Latham and Sunbeam showed considerable susceptibility, while Lloyd George is known to be highly susceptible to the Oregon strain of *Verticillium*. In connexion with the last variety it is noted that the term "blue stripe wilt" is used by R. V. Harris to describe the verticillium wilt on plants in England.* Among blackberries, Cory Thornless, Kittatinny, Logan, Lucretia, Mammoth, Phenomenal, Snyder and Stuart showed some infection, whereas Evergreen, Himalaya, Lawton and wild Northwestern Trailing (*Rubus macropetalus*) proved highly resistant. Three suggestions are made for the control of wilt:—(1) Rogue infected plants where less than about 5% are diseased, (2) rotate crops to rid the soil of wilt contamination, and (3) use planting stock from nurseries that are free from wilt.

72. COUDERC, M. 632.48 : 634.53
Les porte-greffes du châtaignier et la maladie de l'encre. (Rootstocks for chestnuts in relation to the "ink disease", *Coryneum* sp.)
Progr. agric. vitic., 1936, 106 : 305-8, 352-6, 423-7 and 449-52.

Following a brief historical review of the introduction and spread of the serious "ink disease" (maladie de l'encre) of chestnuts, which is caused by a fungus, *Coryneum* sp., and of the early introductions of foreign chestnuts into France, the author gives an account of the experimental plots situated at Lazuel, 2 kilometres to the north-west of Aubenas. The area had previously supported native chestnuts which had, however, been almost entirely eradicated by the disease. Variety trials were initiated by Georges Couderc in 1919 with a view to finding rootstocks resistant to the disease. The procedure adopted by Couderc was not, however, the same as that which he had employed successfully in the search for phylloxera-resistant vine stocks. With the exception of a cross between a Japanese chestnut and *Castanea vesca* no attempt was made to raise hybrid stocks, but, instead, seeds of some 24 lots of chestnut and oak were obtained, principally from the Far East and to some extent from species cultivated in Europe. Altogether some 600 trees of oriental species or their hybrids have been planted. A number of local chestnuts were also planted to provide sources of infection. Descriptions are given of the major characteristics of the 12 principal types and their varieties. Most of the trees are now about 15 years old and have exhibited a considerable degree of resistance to the "ink disease", and it is hoped to select as rootstocks the types showing the greatest vigour and the closest affinity with indigenous varieties. In addition, certain of the trees under trial have produced good crops of fruit, which, if not so satisfactory as those of native varieties for the confectionery trade, might serve a number of useful purposes.

* *Annu. Rep. E. Mallings Res. Sta. for 1924*, A5, 1925, pp. 126-33.

73. MALENOTTI, E. 634.11-2.78
 Quarto anno di osservazioni e di prove sui nemici del melo. (**A fourth year's observations and control experiments on apple pests.**)
Ital. agric., 1936, 73 : 591-607.

This article deals mainly with the codling moth. Traps for snaring the first moths failed in their purpose of indicating the proper time to start control spraying. There are three generations of codling in the year in the district round Verona, the last not being completed. Trapping the larvae with corrugated cardboard impregnated with naphthalene was successful, but owing to great variation in results it has been impossible to determine whether there is any advantage in impregnated over untreated bands. Lime-sulphur of 26° Be. density proved efficacious against scab, the last and fifth treatment being combined with that for codling. Five treatments against *C. pomonella* with 0.3% lead arsenate solution (3 pre- and 2 post-blossom sprays) reduced infestation of apples from 42% to 2.3% and proved slightly better than 4 treatments with 0.5% lead arsenate.

74. DANIEL, D. M., AND COX, J. A. 632.78 : 634.14
Oriental fruit moth control in quince plantings.
Bull. N.Y. St. agric. Exp. Sta. 669, 1936, pp. 16, bibl. 2 in text.

Quince fruits in Western New York generally show approximately 100% infestation by the oriental fruit moth, *Grapholitha molesta* Busck. In studies on biological control it was found that the larval parasite, *Macrocentrus ancylivorus*, which has proved effective in controlling the oriental fruit moth in peach orchards, failed to exert an appreciable influence on the same pest on quince trees. *Ascogaster carpocapsae*, a natural enemy of the codling moth and occasional parasite of the oriental fruit moth, was also liberated in large numbers, but resulted in little increase in parasitism. Experiments with insecticides were carried out in 1933, 1934 and 1935, and the results obtained are tabulated and discussed. The least effective treatment gave 84% clean fruit and most treatments gave over 90% clean fruit. Three alternative spray programmes are suggested, in each of which 7 applications are given at fortnightly intervals starting with a calyx spray, i.e. at blossom fall, and ending about 1 month before harvest :—(1) 3 lb. lead arsenate + a sticker or spreader, in which case the fruit will have to be washed ; (2) 1 gallon summer oil + 1 pint nicotine sulphate ; and (3) 6 lb. of Black Leaf 155. In the last two cases washing is unnecessary. The large number of applications is necessitated by the fact that the caterpillars hatch and burrow into the fruit throughout the entire season.

75. TAKIZAWA, M. 634.11-2.78
Studies on the apple fruit borer, *Grapholitha inopinata* Heinrich.
 [Japanese, English summary.]
Res. Bull. S. Manchuria Rly. Co., 16, 1936, pp. 77-112, bibl. 10.

The life history of the apple fruit boring moth, *Grapholitha (Cydia) inopinata*, is worked out and control measures are suggested. The exact distribution of the insect is not certain, but it appears to be confined to Southern Manchuria. The larvae bore into the fruit, rarely penetrating as far as the centre. Fair control was obtained with a spray composed of lead arsenate 2 lb., nicotine sulphate 200 c.c., water 180 litres, applied in summer on dates which differ with the varieties and the season. Trapping with baited pan traps was comparatively ineffective. Banding the branches (rather than the trunks) with cloth burlap or newspaper or wrapping the fruit in paper bags in July gave good results, but the latter method is too expensive for use on a large scale.

76. DRIGGERS, B. F. 632.78
Codling moth experiments in New Jersey in 1935.
J. econ. Ent., 1936, 29 : 369-78.

Trials of 10 different combinations of nicotine compared with lead arsenate-lime and lead arsenate-summer oil were made on 3 apple varieties in an area where codling moth produced two broods per season. The highest proportion of clean fruit was produced in plots sprayed with Black Leaf

155 B, a proprietary bentonite-nicotine compound containing a zinc sticker, but when wormy fruits were considered alone, i.e. without stung fruits, oil-lead arsenate gave the best results, being followed by Black Leaf 155 B and a tank-mixed bentonite-nicotine-milk spray finished off with oil-nicotine. Severe foliage injury appeared late in the season, however, on two of the varieties sprayed with Black Leaf 155 B. Results obtained with the other treatments are tabulated and discussed.

77. MARSHALL, J., AND GROVES, K. 632.78 : 632.951.23
Three-year study of calcium arsenate for codling moth control.
J. econ. Ent., 1936, 29 : 658-69, bibl. 3.

Experiments are described on the use of calcium arsenate mixtures in sprays for the control of codling moth in the Wenatchee valley of Washington State. Many of the results obtained over the 3-year period 1933-5 have already been discussed in an earlier paper,* but the following points may be noted from the present publication. Severe arsenical injury has resulted from the use of calcium arsenate alone and where animal and vegetable oils have been added. Small amounts of zinc sulphate and calcium hydrate added to calcium arsenate have prevented spray damage, and highly refined petroleum oil has also been largely successful in this respect. Petroleum oil increased the arsenical deposit and improved codling moth control, heavy oils being more effective than medium. It is recommended, however, that zinc sulphate and calcium hydrate be added to the calcium arsenate-petroleum oil spray to ensure a suitable margin of safety from arsenical injury. Petroleum oil of low unsulphonatable residue has proved unsatisfactory, and an ammonium caseinate (paste) emulsion of petroleum oil used with calcium arsenate has produced an undesirable, spotted, arsenical deposit. Preliminary investigations suggest, however, that this uneven deposit can be avoided through the use of an organic soap emulsion of oil in the presence of a small amount of zinc sulphate. Without petroleum oil it has been found difficult to maintain so satisfactory a deposit with calcium arsenate as with lead arsenate, but, where oil has been added and equal or greater deposits have been maintained, the degree of codling moth control has compared favourably with that exerted by lead arsenate with or without herring oil. The costs of the two spray mixtures have been fairly similar, and residue removal with calcium arsenate has not been so difficult as with lead arsenate similarly used.

78. GUY, H. G., AND OTHERS. 632.78 : 632.951
Effect of procedure on performance of certain insecticides recommended for codling moth control.
J. econ. Ent., 1936, 29 : 378-83, bibl. 4.

The extent of replication in experimental layouts in orchards is limited by the number of trees in each plot, and several workers have therefore advocated the use of single-tree plots in spraying experiments with no marginal border of guard trees to prevent overlapping of treatments due to spray carried by winds from one plot to the next. Other workers have insisted, on the other hand, that guard rows are necessary, and that in a square nine trees are the minimum number fulfilling this requirement, records being taken from the protected tree in the centre. The effect of the two arrangements on the performance of five insecticides applied to control codling moth was studied during 1935 in Delaware under conditions where winds persistently interfered with spraying. A block of uniform 24-year-old Jonathan apple trees, planted 30' x 30', was divided into two adjacent sections of 225 and 25 trees respectively. Each section formed a Latin square and was subdivided into 25 plots providing 5 replicates for each of the 5 insecticides. Thus each plot consisted in the one case of 9 trees, of which the centre one was recorded, and in the other case of one tree. The layout and treatment of the two sections were similar in all other respects. The entire crop of the recorded trees was examined and graded for codling moth injury, and chemical analyses were made of both leaf and fruit samples to determine the amount of spray drift between the various plots. Of the spray materials tested, lead arsenate proved

* See *H.A.*, 1936, 6 : 2 : 311.

distinctly more effective than the other materials, which, ranked in order of effectiveness, were, calcium arsenate, zinc arsenate, Kalo and Manganar.* The relative efficiency of these insecticides was not affected by spray drift when tested by the single-tree plot procedure. Spray drift caused adulteration of the spray deposits on the foliage of the trees in the single-tree plots, but the fruit was largely protected by the foliage from such adulteration. It is concluded that single-tree plots possess the advantage of covering a small area and thus provide replicates less subject to pronounced environmental differences than plots with guard rows. On the other hand it is held that these plots should be enlarged by one or two trees to allow for the possibility of a poor set of fruit and should also be replicated a sufficient number of times to offset such a condition.

79. HAMMER, O. H. 632.76 : 634.11

The biology of the apple curculio.

Tech. Bull. N.Y. St. agric. Exp. Sta., **240**, 1936, pp. 50, bibl. 29.

This weevil, *Tachypterus quadrigibbus* Say., which is widespread in the United States, is also present in Eastern Canada and British Columbia. Feeding and egg punctures by over-wintered beetles cause the fruit to become gnarled and pitted. Punctures by the new generation cause dark sunken patches on the surface of ripening fruit. There are marked differences in degree of susceptibility between varieties of apple, though none are immune. Most susceptible varieties are Tolman Sweet, Wealthy, Delicious, Spy, Winter Banana, Ben Davis.

80. HOUSER, J. S., AND NEISWANDER, R. B. 634.11-2.76

A new and effective control for apple flea weevil.

J. econ. Ent., 1936, **29** : 481-2.

Spraying trials in Ohio in 1934 and 1935 have shown fluorine to be highly toxic to the adults of the apple flea weevil. The mixture used consisted of 5 lb. Dutox or Kalo, two fluorine products, 8 lb. flotation sulphur and 3 oz. Goulac per 100 gall. water. Two applications were made, one during the pre-pink stage and the other in the full pink stage, and it was noted that, in addition to the control of the flea weevil, the sprayed plots were practically free from apple scab infection.

81. FLEMING, W. E., AND METZGER, F. W. 632.76

Control of the Japanese beetle and its grubs in home yards.†

Circ. U.S. Dep. Agric., **401**, 1936, pp. 14.

The distribution of the Japanese beetle, *Popillia japonica*, in the U.S. and the nature of its injury are described. Under some garden conditions the most satisfactory way of controlling the pest is to grow species of plants which are injured to only a slight extent or are not attacked by the beetle. A list of vegetables, herbaceous plants, and shrubs and trees fulfilling this requirement is given. Three fruits also listed are pear, gooseberry and dewberry. The planting of "trap" plants such as castor-bean and some species of geranium, which cause paralysis in beetles feeding on them, is of little value, since these plants are insufficiently attractive to induce beetles to leave favourite host plants in the immediate vicinity. Jarring heavily infested plants early in the morning and catching the beetles in sheets is one of the simplest methods of control. Contact sprays properly applied will destroy a large number of beetles on the foliage. One of the best consists of sodium oleate and an alcoholic extract of pyrethrum flowers diluted in water. Where only a few plants are to be treated, 1 lb. fish-oil soap or a better-grade household soap to 3-4 gall. water may be used. Baited traps are of particular value in lightly infested areas, and the type which has given the most satisfactory results is illustrated. In heavily infested areas the value of traps is diminished by the constant influx of beetles from surrounding properties. Individual methods of protecting non-flowering and flowering plants, vegetables, small-fruits, grapes, tree fruits and lawns are outlined briefly.

* Proprietary substances.

† This circular is a revision of and supersedes *Circ.* 326, 1934, Fleming, W. E. and others, "Protecting plants in the home yard from injury by the Japanese beetle."

82. METZGER, F. W., AND LIPP, J. W. 632.76 : 632.951
Value of lime and aluminum sulfate as a repellent spray for Japanese beetle.
J. econ. Ent., 1936, 29 : 343-7.

Aluminium sulphate has been found to improve the adhesiveness of hydrated lime to foliage. Field trials of this spray mixture as a repellent for the Japanese beetle, *Popillia japonica*, were carried out in a heavily infested area in New Jersey in the summer of 1935. 20 lb. hydrated lime and 3 lb. aluminium sulphate to 100 gall. water, applied 3 times at intervals of 7-10 days, afforded protection to the foliage of Yellow Transparent and Red Astrakhan apples, but to early ripening fruit only where careful orchard sanitation was practised and the crop ripened uniformly. The foliage and fruit of peaches and the foliage of cultivated blueberries and rhubarb were also protected by the same combination, but in the case of early ripening peaches the spray could not be applied after 1 July because of the objectionable residue. Three applications of 20 lb. hydrated lime, 6 lb. aluminium sulphate and $\frac{1}{2}$ lb. sodium lauryl sulphate to 100 gall. water materially reduced beetle injury on asparagus brush.

83. SNYDER, E. 634.8-1.541.11-2.651.3
Susceptibility of grape rootstocks to root knot nematode.
Circ. U.S. Dep. Agric., 405, 1936, pp. 15.

The root knot nematode, *Heterodera marioni* (Cornu) Goodey is rapidly becoming one of the major pests of *Vitis vinifera* grape varieties in the U.S. Five vines each of 154 Vinifera varieties were planted in heavily infested soil at Schafter, California, and after growing for one season the plants were dug up and examined. In every case heavy nematode infestations were found on the roots. Some 60 different rootstocks were also tested. None was found to be immune, and the majority were too susceptible to be considered of further value as nematode resistant stocks. A few, however, showed a considerable degree of resistance, and of these the following have been selected for further trial because of their vigour and general adaptability:—Dog Ridge (*Vitis Champinii*), Salt Creek (*V. Doamiana*) and Solonis (*V. Longii*) × Othello (*V. riparia* × *V. Labrusca*) × *V. vinifera*) No. 1613.

84. MUNRO, H. K., AND FOUCHE, F. A. 632.752
A list of the scale insects and mealy bugs (*Coccidae*) and their host-plants in South Africa.
Bull. Dep. Agric. S. Afr., 158, 1936, pp. 104.

A comprehensive list of host-plants supplying both common and Latin names is given with the scale insects and mealy bugs found on each noted underneath. The coccids are similarly arranged in a second list in alphabetical order according to their scientific names with host-plants noted underneath. Nursery quarantine pests are denoted in both lists by an asterisk. Vocabularies of English and Afrikaans common names of the insects are appended.

85. DUTTON, W. C. 634.11-2.752/3
Orchard trials of dinitro-o-cyclohexylphenol in petroleum oil for control of rosy apple aphid and San José scale.
J. econ. Ent., 1936, 29 : 62-5.

Orchard experiments made in 1935 indicate that dilute sprays containing from 1.2% to 2.4% petroleum oil and from 0.05% to 0.1% dinitro-o-cyclohexylphenol are effective against the San José scale, *Aspidiotus perniciosus*, and against the eggs of the rosy apple aphid, *Anuraphis roseus*, and the black cherry aphid, *Myzus cerasi*, and will give satisfactory control without risk of injury to the trees.

86. FARRAR, M. D. 632.73 : 634.75 : 581.162.3
Effect of thrips on pollination and blossom blight in strawberries.
J. econ. Ent., 1936, 29 : 483-6, bibl. 9.

Thrips, almost exclusively the species *Frankliniella tritici*, are associated with strawberries only during the blossoming period, when they invade strawberry fields in large numbers. Laboratory

and field experiments during 3 years have shown, however, that they are only to a very limited extent responsible for the so-called blossom "blight" and are only a minor limiting factor in pollination and the production of fruit. Pollination in the strawberry has been found to be strongly associated with the order of blooming. The first bloom borne by a plant will set fruit irrespective of the presence of thrips, the two blooms second in order will set fruit to a lesser extent, the four blooms third in order still less, and the eight blooms fourth in order will seldom be pollinated. "Blight" has been found to occur on infested and weak blooms produced late in the order of flowering, and thus thrips may reduce the total number of blooms pollinated. On the other hand, the number of fruits set, even when thrips are present, is normally excessive, and these excess fruits are aborted and never mature. Hence the blighting of late blooms has little, if any, effect on the number of fruits reaching maturity.

87. COOLEY, L. M.

634.711.3 + 632.51

Wild bramble eradication.

Bull. N.Y. St. agric. Exp. Sta., **674**, 1936, pp. 32, bibl. in text.

From 1932 to 1935, means of eradicating wild brambles, and particularly wild red raspberries, have been studied in western New York. Common methods, such as grubbing, mowing, burning, the grazing of livestock and especially clean cultivation have been found efficient when properly managed; but in many cases none of these methods is expedient. Attention has, therefore, been paid to the use of chemicals, and of those tested ammonium sulphocyanate in both crude liquor and crude crystalline forms, sodium chlorate, sodium arsenite and the proprietary chlorate mixtures, Atlacide and Vegicide, have proved effective, whereas sodium chloride, kerosene, sulphuric acid, lime-sulphur, copper sulphate, ammonium sulphate, calcium cyanamide, sodium nitrate and sodium carbonate have had comparatively little or no destructive influence. Recommendations on the use of the effective materials are given, based on the results of experiments with different rates, methods and seasons of application. Of the several types of wild bramble, blackberries proved the most resistant to all the toxic chemicals, and purple or hybrid raspberries were also quite resistant. Wild red raspberries, black raspberries and dewberries, however, all succumbed readily, but in any given species resistance to the action of herbicides rose markedly with increased vigour of growth. The most effective means of applying the chemicals proved to be a fine mist spray on the foliage. The chlorates, but not ammonium sulphocyanate, also gave good results when applied as dusts to the foliage or to the soil surface. The brambles appeared to be most susceptible to treatment at the time of fruiting in midsummer. Ammonium sulphocyanate had appreciably less effect at other seasons and was non-effective in winter. Sodium chlorate, on the other hand, destroyed the plant at all seasons, including winter, but its action was again most marked in midsummer.

88. COOLEY, L. M.

634.711.3 + 632.51 : 632.8

Wild brambles in relation to spread of virus diseases in cultivated black raspberries.

Bull. N.Y. St. agric. Exp. Sta., **665**, 1936, pp. 15.

Wild red raspberries, *Rubus Ideaus*, principally var. *strigosus*, are numerous in western New York, where they have been found usually to be infected with green mosaic, yellow mosaic or with both viruses. They also support steady populations of the mosaic vector, the aphid *Amphorophora rubi*, and have been shown to be an important factor in the spread of mosaic diseases into cultivated plantations of red and black raspberries. In fact, in three experimental black raspberry blocks the control of mosaic by inspection and roguing proved impossible until wild red raspberries in the vicinity had been eradicated. Observations suggest that, for any eradication programme to be effective, all wild raspberries within a distance of at least 1,000 feet from the cultivated plants should be removed. Other wild bramble species, notably blackberries, mainly *R. allegheniensis*, and black raspberries, *R. occidentalis*, were rarely found to be mosaic-infected and, since they were also relatively unfavourable hosts for the vector, appeared to play little part in the spread of the disease. Another virus disease, leaf curl, was only found in wild red and black raspberries in four instances, but the vector, *Aphis rubicola*, was common on both

species. The spread of leaf curl from these few diseased plants to cultivated raspberries was very slow, but occurred as readily from distant as from nearby sources. The eradication of obviously infected wild red and black raspberries in the vicinity of healthy plantations is advocated as a means of preventing invasions. Wild black raspberries and blackberries were found to be infected with the streak viruses in a few cases, but it is not considered that they are important sources of infection. On the other hand it is suspected that they harbour the unknown vector of the streak, and they should therefore be eradicated from the vicinity of plantations containing streak infected plants.

89. MASSELIN, J. 634.8-2.954
 A propos de la destruction des herbes vivaces dans les vignes. (**The destruction of perennial weeds in vineyards by means of sodium chlorate.**)
Progr. agric. vitic., 1936, 106 : 397-400.

The destruction of perennial weeds such as couch grass and bindweed in vineyards by means of repeated cultivations and removal of the rhizomes exposed on the surface is laborious and not always entirely effective. The use of corrosive and dehydrating agents such as sulphuric acid merely kills the aerial parts and leaves the roots uninjured. Similarly materials toxic to plants such as sodium chlorate, if applied in the spring and early summer to destroy annual weeds, only concentrate in, and kill, the aerial parts of perennial weeds. On the other hand, it has been found that if chlorates were applied in the autumn and early winter when the weeds were growing only slowly and were storing materials in their roots, the toxin was also transported to the roots and slowly but surely destroyed them. The question then arose as to whether vines, though dormant at this season and naturally tolerant to soil chlorates, would be injured by the treatment. Experiments were started in 1932, and up to the present over 150 trials have been made in collaboration with more than 100 growers in both dry and wet years and in a wide range of soil types. As a result the following technique is recommended :—In October, November or at latest December, select a period of light drizzling rain and broadcast sodium chlorate in finely powdered form at the rate of 15 grams per square metre (150 kg. per hectare or 133.5 lb. per acre). In sandy, permeable soils 20 grams may, however, be necessary. Using solutions of sodium chlorate has proved less satisfactory, since at fairly high concentrations of, say, 10%, and especially when the weather is dry and the weed cover dense, the salt tends to crystallize out on the leaves, while at lower concentrations too much water is needed. Employing the technique described above, couch grass has usually been almost entirely eradicated, the rhizomes being found black and decomposing in the spring. In other trials bindweed has also been eradicated. The treatment has failed only in exceptionally sandy and porous soils and where very heavy rain has occurred directly after treatment. As regards the effects on the vines the trials have shown that the treatment should never be applied to saline soil or to newly planted vines. Apart from these two cases 96% of the trials have shown no injurious effects on the vines. In the remaining 4% which were usually associated with acid, badly drained soils, overlying impermeable rock, some scorching of the foliage at the base of the branches was observed the following summer.

90. HOYER, D. G., AND LEONARD, M. D. 632.951.1 : 581.192 : 589.98
Pyrethrin content of pyrethrum flowers from various sources.
J. econ. Ent., 1936, 29 : 605-6.

A table is given showing the sources of imports of pyrethrum flowers into the U.S.A. during 1932, 1933 and 1934, together with the quantity and its value from each country of origin. Analyses have shown that the flowers from Kenya possess the highest content of pyrethrin I and pyrethrin II. Of the more important sources of supply Japan produces flowers with the greatest toxin content, while Dalmatian flowers, ranking second in amounts imported, possess only about half the Japanese pyrethrin content. These figures refer to *Chrysanthemum cinerariaefolium*. In the U.S.S.R. the species grown is *C. roseum* and these flowers possess on an average the lowest pyrethrin content.

91. ACREE, F., AND OTHERS. 632.951.1 : 581.192 : 589.98
Constituents of pyrethrum flowers. III. The pyrethrin content of fresh flowers.
J. econ. Ent., 1936, **29** : 601-5, bibl. 5.

A study was made of pyrethrum flowers to determine whether the pyrethrins are present in the fresh flowers, and if so, to what extent they are affected by enzyme activity and moisture content in the process of drying. The results confirm those of Gnadinger and co-workers in that the method of drying produces very little variation in the pyrethrin content of the flowers. It is shown that the pyrethrin I and pyrethrin II exist as such in the fresh pyrethrum flowers. Enzymes and moisture have a negligible effect on the synthesis or decomposition of the pyrethrins in the process of drying the flowers. [Authors' summary.]

92. FAES, H. 632.951.1 : 589.98
 Le pyrèthre et sa culture. (**Pyrethrum and its cultivation.**)
Rev. hort. suisse, 1936, **9** : 49-53.

The expansion of the world's output of pyrethrum is noted, and it is pointed out that the relatively small part played by France and Switzerland in this expansion has been due to the fact that European labour cannot compete with the low-paid labour in Japan where the great bulk of the world's supply is produced. Two fundamental mistakes also helped to restrict the production and utilization of pyrethrum for many years. First it was considered that seed, normally obtained from Dalmatia, gave a very low percentage germination. This was subsequently found to be due to faulty picking whereby the flowers were pulled off, leaving the seeds behind in the receptacle. Seed collected properly in Switzerland has usually given about 80% germination. The second mistake occurred in the markets, where for a long time higher prices were paid for dried flower buds than for dried half-open or open flowers. After Staudinger and Ruzicka, at Zürich, had found the means of isolating pyrethrins I and II, it became an easy matter to show that the flower buds contained very little of these active principles and that the proportion of pyrethrins increased proportionately with the stage of development of the flowers. Recommendations are also made for the growing and harvesting of pyrethrum in Switzerland. A form of steel rake fixed in an inverted position on a table and used to separate the flower heads from the stalks is described.

93. SHAFIK, M., AND HINDI, A. H. 632.951.1 : 581.192 : 589.98
Studies on pyrethrum (*Chrysanthemum cinerariaefolium* Trev.) in Egypt. I.

Bull. tech. sci. Serv. (Ent. Sect.), Minist. Agric. Egypt, **166**, 1936, pp. 24, bibl. 37.

In recent years the Horticultural Section in Egypt has begun to distribute seedlings of *C. cinerariaefolium* to farmers, and it is hoped that the country will shortly become an extensive producer and exporter of pyrethrum. A study was therefore undertaken to determine the best localities in Egypt for the growing of pyrethrum and the production of flowers with the highest contents of pyrethrins, and also to determine the influence of meteorological and environmental conditions on yields. Plants raised at Dukki from seed obtained from France were distributed in trial plots all over the country, and records of growth, flower yields and pyrethrin content were kept for each plot. The results indicate that *C. cinerariaefolium* will grow well in most parts of Egypt with the exception of the extreme south, where the climate is hot and dry, and of soils in which there is a high water table. High temperatures accompanied by low humidity appear to have an adverse effect on growth of the plants, number of flowers and pyrethrin content, but to have no effect on the weight of the individual flower heads. Soil fertility was also found to have no significant influence on the weight of flowers, nor on the pyrethrin content, but the number of flowers per plant increased markedly with greater soil fertility. As far as cultural practices are concerned, the best time for sowing the seed has proved to be late June or early July and for transplanting early October. Suggested spacing distances are 60 cm. between rows and 30-50 cm. between plants in the rows. In irrigation a little water should be given at frequent intervals to avoid applying excessive amounts at any one time. Analyses

were also made to determine the stage of development at which the flowers possess the highest pyrethrin content. Flowers at 5 stages from "small bud" to fully open were collected from each of a number of selected plants, and the highest percentage of pyrethrin I was found in the fully opened flowers. The literature on the chemical composition and estimation of the active principles of pyrethrum is reviewed.

94. LOEWEL, E. L., AND LÜTTGAU, W. 632.95 : 638.14
Obstbaumspritzung und Bienensterben im Altländer Obstbaugbiet. (**Spraying and bee mortality in Altenland orchards.**)
Gartenbauwiss., 1936, 10 : 521-36, bibl. 4.

Owing to continued loss of bees due to spraying, trials were made in the winter of the effect of many of the common scab and combination sprays on bees in the hive with sugar and water as controls. The substances thus tested were :—2% lime sulphur, with the addition of 0.2% alvesco, a patent material for increasing adhesion; 2% alvesco; 2% lime sulphur + 0.2% aresin, a calcium arsenate substance; 0.2% aresin; 2% lime sulphur; 1% nosprasi W; 1% bordeaux mixture; 1% bordeaux (Wacker); 0.4% lead arsenate powder; 2% lime sulphur + 0.4% lead arsenate powder; water; sugar solution 1:4. It was found that of the spray materials only lime sulphur and alvesco and alvesco alone did not poison the bees, their effect being approximately the same as that of water alone. The addition of the alvesco increases the efficiency of the lime sulphur but even so its control of scab falls much behind that of lime sulphur and lead arsenate and that of the copper sprays.

95. DAVIES, C., AND SMYTH-HOMEWOOD, G. R. B. 632.94
Investigations on machinery used in spraying. Part III, The output and range of nozzles and guns.
J. S.E. Agric. Coll., Wye, 1937, No. 39, pp. 61-72.

The output from spray-nozzles in gallons per minute was evaluated by weighing the clear water, caught in a vessel suspended on a spring balance, delivered through a bent funnel (used to prevent splashing) into which the nozzle or nozzles were inserted. Many kinds of nozzle (described) were tested thus at different pump pressures. The accurate measurement of nozzle-carry proved to be more difficult, but a method was evolved and is described, which is independent of estimation by eye. The force of the spray-cone, delivered under known pressure by the test nozzle, was balanced against that delivered under constant pressure by another nozzle spraying against it in a diametrically opposite direction, and the distance from the test nozzle to this point of balance was measured to give the distance of carry. The output and distance of carry from spray-guns were tested in a similar way. All the results of these investigations are set out in tabular form: the paper contains seven tables. The apical angle of the spray-cones was measured in each case and is recorded in the tables in preference to the more complicated details of internal nozzle-adjustments, such as eddy-chamber depth, vortex-openings, etc., which govern the output and range of carry. The celluloid-disc technique,* used for the measurement of spray-cover in the field, was tested during routine spraying on a number of farms in 1936, but the superiority of any particular gun or nozzle was not established by the results obtained. M.H.M.

96. GINSBURG, J. M. 632.951
Results with home-made oil emulsions for orchard spraying.
J. econ. Ent., 1936, 29 : 361-4.

Spraying trials in New Jersey apple orchards have shown that home-made dormant and summer oil emulsions will give as effective control of insect pests as do comparable commercial oils. Formulae and methods of preparation are detailed for three dormant, and two summer, oil emulsions.

* Described *Ibidem*, 1934, No. 34, pp. 352-3, *H.A.*, 1934, 4 : 3 : 386.

97. GOODHUE, L. D., AND FLEMING, W. E. 632.951.1
Stickers for derris applied as an insecticidal spray.
J. econ. Ent., 1936, 29 : 580-3, bibl. 3.

Out of a number of materials tested, first on glass plates and then on bean foliage, rosin residue, the material left in the still during the manufacture of rosin, when emulsified with ammonium caseinate, proved to be the most satisfactory and inexpensive sticker for derris used as a spray against the Japanese beetle. Among other good stickers asphalt emulsion had an objectionable black colour, agar-agar was difficult to prepare and too costly, latex decomposed rapidly in sunlight, and oils, such as sardine, castor and Menhaden, increased the rate of deterioration of derris in sunlight.

98. HENSILL, G. S., AND HOSKINS, W. M. 632.951 + 632.951.23
Factors concerned in the deposit of sprays. I. The effect of different concentrations of wetting agents.
 HOSKINS, W. M., AND WAMPLER, E. L.
Factors concerned in the deposit of sprays. II. Effect of electrostatic charge upon the deposit of lead arsenate.
J. econ. Ent., 1935, 28 : 942-50, bibl. 22 ; and 1936, 29 : 134-43, bibl. 13.

(1) The use of many different materials to facilitate the wetting of plant and animal surfaces with insecticidal sprays has caused great stress to be laid upon the importance of forming a continuous film of spray liquid upon the surface during spraying. The effect of formation of a film is to stop the increase in the amount of insecticide deposited upon the surface as spray liquid falls upon it. This initial or primary deposit is supplemented by a secondary deposit of the insecticide contained in the film. The various wetting agents bring about film formation after different intervals and hence affect the total amount of deposit. Their action is also dependent upon the concentration at which they are used. Determination of the deposit of oil and of lead arsenate with different concentrations of blood albumin spreader, Kayso and triethanolamine oleate, shows that maximum deposit is obtained, under the condition that a constant volume of each spray is applied to equal areas of wax, with a characteristic concentration of each wetting agent and not with the mechanical mixtures containing none. This indicates that the surface is altered at different rates and to different extents by the various wetting agents.

(2) A microcataphoresis cell for the determination of the electrostatic charge of suspensions is described and figured. Suspensions of acid lead arsenate in water have a negative charge. Very low concentrations of polyvalent positive ions, e.g. Al^{+++} , decrease this charge and higher concentrations give a strong positive charge to the suspension. Beeswax suspensions act similarly to lead arsenate. Solutions containing aluminium ion in the concentration range, which gives little or no charge to particles of wax in suspension, wet a surface of the same kind of wax. The deposit of lead arsenate varies with the concentration of aluminium present. It is increased by concentrations which give a low positive charge to the lead arsenate and leave a negative charge on the wax surface, but it is greatly diminished when both the lead arsenate and the wax are positively charged. The effect of wetting agents upon this effect is dependent upon the amount used. [Authors' summaries.]

99. KADOW, K. J., AND ANDERSON, H. W. 546.47 : 632.951.2 : 634.25 + 634.11
Further studies on zinc sulfate in peach sprays, with limited tests in apple sprays.

Bull. Ill. agric. Exp. Sta., 424, 1936, pp. 131-44, bibl. 22.

The study of zinc sulphate as an ingredient of peach and apple sprays in Illinois is terminated with the data presented in this paper. Many of the results reviewed here have already been described in *Bulletin 414 (H.A., 1936, 6 : 1 : 80)*. The general conclusions drawn are as follows:—

(1) Zinc sulphate should always be added to acid lead arsenate plus lime to prevent injury when this spray is applied to peaches in Illinois. Under normal field conditions 1 lb. $ZnSO_4 \cdot 7H_2O$ added to 3 lb. acid lead arsenate and 3 lb. hydrated lime per 100 gall. water reduced spray injury as effectively as did higher amounts. Quantities smaller than 1 lb. have not been tested in

the field, but in laboratory experiments $\frac{1}{4}$ lb. zinc sulphate added to mixtures of lead arsenate and lime proved as effective as larger amounts in reducing water-soluble arsenic. On the other hand in abnormal seasons such as 1935 zinc sulphate failed to prevent considerable spray injury. Frequent light showers, heavy night dews and high humidity are considered to be the factors which accentuate this injury. (2) The effect of zinc sulphate upon arsenical injury to apple foliage was not determined, but when it was used at concentrations of 8 lb. to 100 gall. water with acid lead arsenate and lime severe russetting occurred on Ben Davis apples. (3) The effect of zinc sulphate on the insecticidal value of lead arsenate and lime has not been demonstrated conclusively in experiments covering 7 years. Limited data secured in connexion with codling moth control suggest that zinc sulphate had no marked influence, but the results obtained in this case were complicated by the fact that oil was added to the sprays. (4) Laboratory and field studies have shown that zinc sulphate has little value as a fungicide in peach or apple sprays. (5) Zinc sulphate has also proved ineffective as a bactericide for the control of bacterial spot on peaches caused by *Phytophthora Pruni*. (6) Finally, under Illinois conditions, zinc sulphate has not been observed to impart any "stimulating effect" to peach trees, although it is noted that in other parts of the country it has proved to be a corrective for certain physiological disorders.

100. WORTHLEY, H. N., AND FREAR, D. E. H. 634.11-2.951.23
Pre-harvest spraying of apples for removal of lead residues.
J. econ. Ent., 1936, 29 : 524-6, bibl. 1.

Stayman Winesap and York Imperial apple trees, which had received about five cover sprays of lead arsenate, were sprayed on 15 September with hydrated lime 10 lb. per 100 gall., ammonium nitrate 8 lb. per 100 gall., and paste Vatsol $\frac{1}{2}$ lb. per 100 gall. to determine if any of these three materials would remove any substantial part of the lead residue on the fruit. Some of the treatments assisted the natural processes of growth and weathering to reduce residue slightly, but in no case did spraying obviate the need for washing the fruit with hydrochloric acid after harvest, nor assist the acid wash to effect greater reductions in the residue.

101. SKIBBE, A. M. 634.13-2.951.23
Removal of spray residue from pears.
Fmg. S. Afr., 1937, 12 : 30-4, bibl. 15.

The whole subject of the removal of arsenical spray residues is discussed in considerable detail. The article concludes with a series of recommendations which concern the dipping of the fruit in a $\frac{1}{2}$ -1 $\frac{1}{2}$ % solution of hydrochloric acid, the strength and the length of the immersion depending on the number of sprayings the fruit has undergone during its growth. There are no definite recommendations for fruit which has been oil-sprayed throughout the season. The fruit should be treated immediately after harvesting to avoid the accumulation of wax.

102. HOUGH, W. S. 632.95 : 634.11
Spray residues and their removal from apples.
Bull. Va agric. Exp. Sta., 302, 1936, pp. 20.

Investigations were carried out in 1934 and 1935 on the operation of various types of washing machines used in northern Virginia and on the effectiveness of different washes for removing lead, arsenical and fluorine residues. The question as to whether washing was necessary was first examined. The lead residue on fruit sprayed with lead arsenate at 3 lb. per 100 gall., in the calyx and two cover sprays ending 11 or 12 June, averaged 0.019 and 0.013 grain per lb. of fruit in 1934 and 1935, respectively, and was usually within, or sufficiently near, the lead tolerance of 0.018 grain per lb. to permit cleaning the fruit without washing. Where lead arsenate was applied in only one cover spray the lead residues were considerably lower, and the maxima in both years were within the tolerance. Two cryolite sprays with 1 pint fish oil per 100 gall. as a sticker, applied on 18 June and 20 July caused a residue equal to the fluorine tolerance of 0.010 grain per lb. Where three sprays of cryolite were applied, the last being on 25 and 26 July, washing was necessary to reduce the residue within the tolerance. In washing

experiments hydrochloric acid proved considerably more efficient than sodium silicate in removing residues of lead, arsenic and fluorine. Satisfactory concentrations of HCl lay between 1 and $4\frac{1}{2}$ gall. per 100 gall. water, depending upon the extent of the residue, and for cleaning most Virginia apples 2 to 3 gall. HCl is considered adequate. Bordeaux mixture in the cover sprays made the removal of lead arsenate less difficult, whereas the use of oil with lead arsenate made it more difficult. There were no differences of practical significance between the efficiency of a flotation washer, a flood washer and two kinds of brush washer when the fruit carried residues which were fairly easily removed. In the case of apples sprayed with lead arsenate plus oil in some cover sprays, the brush washers removed a greater proportion, and the flotation washer a smaller proportion, of lead than did the other types. None of the machines, however, cleaned the fruit sufficiently to meet the tolerance when the acid solution used was cold. Heating the solution increased its efficiency to a marked degree, while the addition of wetting agents increased its effectiveness still further. By contrast, wetting agents proved to be of little or no practical value when added to cold acid solutions. The importance of adequate rinsing in water is stressed, for otherwise arsenical burning may occur at the calyx-end or acid injury wherever the acid solution evaporates on the fruit. Under local conditions arsenical injury is more likely to occur than acid injury. The amount of fresh water required for adequate rinsing was found to depend upon the type of washer, the strength of the acid solution and the rate of washing. Where sufficient water is not available the addition of hydrated lime to the rinse tank is recommended, and a schedule is given for adding lime in the various washing processes.

103. GROVES, K., AND OTHERS. 634.11 : 632.951

The removal of fluorine spray residue from apples sprayed with natural cryolite.

Bull. Wash. St. agric. Exp. Sta., 329, 1936, pp. 15, bibl. in text.

In preliminary washing experiments with Winesap apples, which had received 3, 7 or 8 cover sprays of cryolite, aluminium chloride, reported to be a good solvent for fluorine residue, gave surprisingly poor results when used in a tandem with sodium silicate. Three processes selected for replicated trials were tandem washes with sodium silicate used at a rate of 60 lb. per 100 gall. in the first wash and hydrochloric acid at a concentration of 1.5% in the second wash. In the first process no mineral oil was added; in the second 1% oil of 40 seconds viscosity was added to the acid; and in the third the same concentration of oil was added to the alkali. The temperature of the solution was 110°F. in all cases and the experimental machine described by Karr* was used for washing the majority of the samples. The results obtained were variable and none of the treatments was significantly more effective than the others. A number of observations, based on the preliminary and extended trials, are, however, made with the proviso that too much reliance should not be placed on the results of a single year's experiments:— (1) Increasing the concentration of sodium silicate beyond 60 lb. per 100 gall. causes no apparent increase in its effectiveness. (2) Mineral oil in either or both tanks of a tandem wash is of doubtful value, and the addition of oil to acid in the first wash may actually reduce the cleaning action. (3) Brushes in the acid tank of a tandem washer do not give consistently better results than rollers with all spray programmes. The effect of washing treatments on subsequent moisture losses of the fruit in storage has also been studied and the results are presented in detail in a second paper (see abstract 104).

104. MARSHALL, R. E., AND OTHERS. 634.11 : 632.951

The relation of washing treatments to subsequent losses of moisture from apples.

Bull. Wash. St. agric. Exp. Sta., 330, 1936, pp. 28, bibl. 10.

The apples used in these experiments were stored after picking at a temperature of 32° to 34°F. and a relative humidity of 80 to 85% until November or later, when they were removed for washing and then returned to cold store until finally transferred to "living room" temperatures and humidities for moisture loss determinations. The washing was done in a new tandem machine recently described by Karr.* In the treatments hydrochloric acid was used at a

* *Proc. Wash. St. hort. Ass. for 1935, 1936, 31 : 119-26, H.A., 1936, 6 : 2 : 325.*

concentration of 1.5% by weight, sodium silicate at 60 lb. per 100 gall., mineral oil of viscosity 50 Saybolt at 1% by volume, soda ash at 75 lb. per 100 gall. and aluminium chloride at several concentrations. The period of immersion in either acid or alkali was approximately 25 seconds and was followed by two rinsings lasting for 125 seconds. All the washing treatments resulted in some subsequent acceleration of moisture-loss rates when the fruit was removed from cold storage, but the proportions were not serious when oil was not added to the solutions and their temperatures did not exceed 110°F. Additions of mineral oil caused more or less acceleration in subsequent rates of moisture loss. Added to HCl it resulted in very substantial acceleration, the rate of moisture losses increasing with temperature increases in the range of 90° to 120°F. The greatest losses resulted from tandem acid and silicate solutions each fortified with mineral oil and heated to 120°F. Apples washed in this way lost 15 to 20% of their initial weight in ten days after removal from cold storage. The conclusion is drawn that washing treatments should be as mild as is consistent with satisfactory residue removal. If it appears that oil must be added to an acid solution to reduce residues satisfactorily, the temperature of the solution should be maintained at 90° to 100°F. and never exceed 110°. Moreover, oil should not be added to both solutions of a tandem machine. It is also suggested that apples washed in solutions containing oil should be given some mark of identification, since the longer these fruits can be held in ideal cold storage conditions after washing, the greater will be the wax accumulation to aid in preventing moisture losses subsequent to removal from storage. Finally it was observed that small but consistent differences occurred in rates of moisture losses from apples which had received different spray treatments, but these differences are considered to be too slight to be of importance in selecting sprays.

VEGETABLE GROWING.*

105. BOISCHOT, P., AND DROUINEAU, G. 631.67 : 631.8
 Emploi des engrais en solution. (**Applying fertilizers in irrigation water.**)
C.R. Acad. Agric. Fr., 1936, 22 : 979-84, bibl. 3 in text.

Combining applications of fertilizers and irrigation water is a common practice in the market garden and flower growing districts of Provence. The fertilizer is either drilled in the furrows immediately prior to irrigation or is actually dissolved in the irrigation water. This latter method is almost entirely restricted to single fertilizers, and mixtures are rarely applied in solution. In general these methods have given good results, but failures have occasionally been reported, and the authors considered that the following three points required clarification :—
 (1) At what concentration is there a danger that the various solutions will prove toxic to crops?
 (2) How are fertilizers held in the soil when applied by the two methods?
 (3) Do different fertilizer solutions exert a corrosive effect on the irrigation pipes? The question of toxicity was investigated by applying increasing concentrations of different fertilizers to cos lettuces growing in calcareous clay soil. With nitrate of soda, sulphate of ammonia, superphosphate, and potassium chloride no injury developed from concentrations up to 10%, and with potassium sulphate from concentrations up to 5%. In addition the nitrogenous fertilizers at 10% evoked a marked response in the plants within 4 days. Since the concentration generally recommended is only 0.2%, it is concluded that this may be raised considerably without risk of injury to the plants. The fixation of the fertilizers in the soil was studied by means of small glass percolators into which 150 grams of soil were put in three equal layers separated by filter papers. In one series of percolators 2 grams of fertilizer were mixed with the top layer of soil which was then watered with 200 c.c. of distilled water. In the second series the fertilizer was first dissolved in the water to give a concentration of 1%. In both cases the liquid draining through the percolators was collected and analysed. The results indicate that sulphate of ammonia, nitrate of soda and potassium chloride are retained to a greater extent in the surface layers of the soil

* See also 3, 4, 5, 7, 11, 227.

when applied in the form of solutions, than when mixed with the soil prior to watering. Super-phosphate was completely fixed in both cases. It is recalled that similar results have been obtained with soil profiles in the field. The effect of dissolved fertilizers upon iron irrigation tubes was investigated by placing 10 grams of iron nails in 100 c.c. of a 1% solution of the different fertilizers. After 6 days, analyses for dissolved Fe_2O_3 showed that, with the exception of nitrate of soda, none of the fertilizers affected the iron to so great an extent as did ordinary irrigation water. The general conclusion is reached that the application of fertilizers in solution is a superior method to that of spreading the fertilizers and then irrigating.

106. PALMER, A. E. 631.67 : 633.491

Use of irrigation water on farm crops.

Publ. Canad. Dep. Agric., 509,* being *Fmrs.' Bull.* 10, 1936, pp. 51, bibl. 75.

Investigations on the irrigation of wheat, alfalfa, potatoes, sugar beets and sunflowers are described. With regard to potatoes grown at Lethbridge, Alberta, from 1 to 6 irrigations were applied annually from 1923 to 1927 inclusive at different stages of plant growth. Total yields of marketable and unmarketable tubers are tabulated. The effect of irrigation on quality was studied in 1924 and 1925, but the results were so variable both between the two years and between duplicate treatments in the same year that the only conclusion that could be drawn was that no irrigation treatment affected quality factors sufficiently to overcome individual differences in the tubers. Based upon a consideration of yield alone, therefore, the results would appear to indicate that a good crop of potatoes can usually be raised on fertile, medium textured soils without irrigation during the growing season, provided that the land has been irrigated during the previous autumn. In drier years, however, yields may be increased by irrigating again soon after the plants start to bloom, and by giving two more irrigations at intervals of 20 days. Irrigation prior to blooming appears to be undesirable unless the soil is so dry as to retard growth. Soil moisture determinations were also made, and tables are given showing the total water used by potato crops, evaporated from the soil and percolated below 6 feet. Investigations on the other crops are described in a similar manner, and in each case the literature on the subject is reviewed. The bibliography consists of 49 cited references and 26 references to related literature.

107. KELL, W. V., AND MCKEE, R. 631.874 : 631.459

Cover crops for soil conservation.

Fmrs.' Bull. U.S. Dep. Agric. 1758, 1936, pp. 14.

The advantages and disadvantages of growing cover crops are outlined and notes are provided on the following plants with particular reference to their use in rotations with field crops in different regions or as a ground cover for crops grown in wide rows such as cotton, corn, potatoes or tobacco:—Sweet clover, crimson clover, bur-clover, vetches, Austrian winter field peas, Kudzu and *Lespedeza sericea*, all of which are legumes, and rye, winter oats, wheat, barley, redtop and Italian ryegrass. A list of U.S. Dep. Agric. publications relating to these crops is given at the end of the bulletin.

108. DE PERALTA, F., AND PAGUIRIGAN, D. B. 633.71 : 581.143

Root and top development of tobacco plant with special reference to the cigar wrapper type.

Philipp. J. Agric., 1936, 7 : 175-89, bibl. 3.

The root and shoot development of cigar wrapper-type tobacco grown on level, fertile, sandy clay near Manila was recorded. For the first 40 days after sowing in seed boxes the root growth was only 2-4 mm. per day, while the shoot developed only 5 small leaves with a growth rate of 10-7 sq. mm. per day. This rate of growth is very low compared to that of any other annual crop during the seedling stage, including wheat. The plants were then pricked out in the

* Being revision of *Bull.*, 125.

seed beds and at the end of a further 45 days the growth of the root system had averaged 9.7 cm. per day with secondary roots increasing in number at the rate of one every 5 days, and the tertiary roots at the rate of 2.4 daily. At the end of this period the total length of the root system was 4.37 m. or an increase of 4452%. The leaf surface had increased 2593%, or at the rate of $1\frac{1}{2}$ leaves per 10-day period and with a growth rate of 2.5 sq. cm. per day. The plants were then put out in the field. 48 days later the root system had ceased increasing in width but was proceeding actively downwards. After a further 28 days the plants were 2.2 m. high and almost in full bloom. Root penetration had reached a depth of 50 cm., the number of main roots being about 40, while secondary roots increased in number at the rate of 5.3 for every 10 days and were densely branched. Most of the absorbing roots were in the top foot of soil. Leaf growth had increased 160+ in 28 days and the total green leaf area was 7,300 sq. cm. The methods by which the results were ascertained are described.

109. ANON. 633.822

Peppermint : its cultivation and distillation.

Advis. Leaf. Minist. Agric. Lond., 98, revised 1936,* pp. 4.

Two varieties of peppermint are recognized by growers, black mint, *Mentha piperita* var. *officinalis* and white mint, *M. piperita* var. *vulgaris*. The latter produces oil of superior quality, but black mint gives higher yields and is the variety generally grown in England. Suitable soils and sites, preparation of the soil, propagation, planting and harvesting are described and distillation is mentioned. A good average yield is 30 to 40 lb. oil to the acre from crops of 3 and 4 tons respectively. The "snuff disease" caused by the rust fungus, *Puccinia Menthae*, is described briefly and measures for its control are suggested.

110. BÖNING, K. 633.846-2.3/4

Untersuchungen über Meerrettichkrankheiten und Bekämpfung. (Horse radish diseases and their control.)

Angew. Bot., 1936, 18 : 482-94, bibl. 12.

The following diseases are dealt with :—*Albugo candida*, a white rust ; a black disease of the stems possibly caused by *Verticillium Dahliae* Klebahn ; various bacterial diseases ; a *Sclerotinia* rot ; a *Fusarium* white rot ; a *Penicillium* mould ; and lastly a swelling of the root probably due to *Pseudomonas tumefaciens*. Very brief notes are also given on the more important pests and their control.

111. HOARE, A. H. 635.23

Onion growing in England : a new commercial method.

J. Minist. Agric. Lond., 1936, 43 : 333-40.

In the test on a commercial scale described here seed was sown in August 1934 on a medium loam soil over clay, which had carried a crop of green peas and had been cleared by the end of July. The area seeded was about $\frac{1}{2}$ acre, the seed used (Unwin's Reliance) 3 lb. A mild autumn and winter followed, and after 2 hand hoeings and 1 hand weeding the plants were well grown by the end of February. They were planted out early in March into similar soil, which had in the previous year grown a crop of gladiolus corms and for that had received 8 loads of farmyard manure per acre. Plants were inserted by hand and were put in rows at 18 in. apart with 9 in. between plants. At the end of March 8 cwt. compound fertilizer containing 4.9% N, 7.3% P_2O_5 soluble and 1.24% P_2O_5 insoluble in water, and 6.0% K, 25% of the fertilizer consisting of finely ground guano, was broadcast and hoed in. Three hand hoeings were given. The crop was harvested in the third week of August. The total weight from the acre of land used was 11 tons 14 cwt. Marketing was satisfactory and a profit of £41 on the acre planted is shown by the figures given, and this, in view of the conditions during growth which were actually drier than usual, is considered satisfactory.

* First issued 1932.

112. CHROBOCZEK, E. 635.25 + 664.84.25
 Badania nad uprawa i przechowaniem cebuli. (**Study of some problems connected with growing and storage of onions.**) [Polish, English summary.]
 Reprint from *Roczn. Nauk Ogrodniczych* (Ann. Sci. hort.), 1936, 3: 57-137, bibl. 44.

Manurial trials:—In experiments carried out in Skierniewice from 1922 onwards with the onion variety Wolska, growing on a sandy loam soil, farmyard manure gave yields 20-50% higher than those obtained from commercial fertilizers. The manure decreased the acidity and increased the humus content of the soil, reduced damage to the plants by the onion maggot, *Anthomyia antiqua* L., and promoted earlier ripening. Different fertilizer treatments, i.e. CaNPK, NPK, PK, PN, KN, and no fertilizer (O), were also compared over a 12-year period. Under conditions of high soil acidity Ca had the greatest influence on growth and yield, but under normal conditions K proved the most important element. Lack of K resulted in the poorest development of the plants and the lowest yields, a dark green colour of the tops and dying of the upper halves of the older leaves being symptoms of deficiency. Lack of K also delayed maturity to a marked extent, produced poorly shaped, elongated bulbs lacking in firmness, with the thinnest dry scales and of a dark brownish colour instead of straw yellow. The K₂O content of the bulbs from the PN plots was only 0.75% of the fresh weight compared with 1.34% in onions from the PK plots, while the sugar content of the bulbs from the PN plot was also lower than any except that of the onions from the O plots. The non-fertilized check plots showed delayed maturity, practically no bulb formation, thinness of the dry scales, the lowest ash content of bulbs (3.16% against 4.43% in the CaNPK plot), and the lowest sugar content. CaNPK gave the earliest maturity, the most typically globe-shaped onions, and the firmest bulbs with the thickest dry scales and the highest ash and sugar contents. NPK, KN, and PK appear to have been the next most satisfactory treatments, while PN gave nearly as bad, and in some respects worse, results than O, as already noted above in connexion with the effects of lack of K. Lack of P or N caused very little reduction in yield. *Storage experiments with onions which had received differential manurial treatments*:—Onions were stored in common air-cooled storage during three seasons and in cold storage (the Cooper system) at -0.5°C. with a deviation not exceeding 1°C. and a relative humidity of 78% during one season. By the beginning of June only 30-45% of the bulbs in ordinary storage remained marketable, i.e. sound and without sprouts, compared with 91.5% of the bulbs in cold storage. No differences were observed in the storage qualities of onions which had received manure or full commercial fertilizer. Of the differential fertilizer treatments NPK, PK, and NK gave bulbs which kept well, CaNPK bulbs which started to sprout earlier than those which had received NPK, and PN without potash and O gave bulbs of the poorest keeping quality. Onions harvested when not fully mature kept better than onions pulled when mature, but chemical analyses failed to reveal significant differences in composition to explain this result. *Storage experiments with 30 different varieties*:—A preliminary test was made of the keeping quality of 29 varieties and a complete storage experiment was carried out with 7 varieties. Of the latter, two Polish varieties, Hoser's Wolska and Skierkowski's Zytawska Krajowa, kept much better in both ordinary and cold storage than did Dippe's Zittauer, Eisenkopf, Vertus or Dutch Yellow. It was observed that seed imported from southern countries gave rise to early maturing crops, whereas seed from northern varieties nearly all gave rise to late maturing crops, but no correlation was found between the time of maturity of the 30 varieties and their keeping qualities. In a few extreme cases a rather weak correlation was obtained between keeping quality and a very high dry matter content, a low content of reducing sugars and a high one of protein nitrogen. In general, however, no correlation was found between the contents of dry matter, total sugar, reducing sugar and total protein nitrogen and the keeping qualities of the different varieties. In all the 30 varieties tested the percentage dry matter and reducing sugars increased during storage. Nitrogen and acidity, on the other hand, showed no marked changes between 11 February and 20 March. *Date of placing in cold storage*:—Onions [presumably of the variety Wolska—Ed.] were transferred from common to cold storage at -0.5°C. on 18 December, 1. February and 5 March, and up to 8 June 91% of the bulbs in all these lots remained sound. From mid-December

to early March the new leaves inside the bulbs in common storage increased very little in length, occupying about 64% of the total height of the bulb. On 8 June, after cold storage as noted above, the length of the leaves was about 71% of the height of the bulbs. Onions transferred to cold storage on 3 and 18 April and 5 May gave proportions of sound bulbs on 8 June of 88, 82 and 70% respectively. Onions transferred on 5 May had leaves occupying 89.5% of the height of the bulbs, and in early June leaves were protruding out of some of the bulbs. The date on which the onions were placed in cold store had a considerable effect on the life of the bulbs after removal from cold storage on 8 June. Bulbs kept for two weeks at 15-20°C. after removal from cold storage showed a range of 75.5 to 32.5% sound bulbs between onions placed in cold store on 15 December and 5 May. After three weeks the range lay between 42.5 and 15.5%. *CO₂ storage* :—Increasing the CO₂ content of the atmosphere reduced the amount of sprouting in onions stored at room temperatures, but colour, flavour and chemical composition were not altered by storage for 2 months even in high CO₂ concentrations.

113. WALLACE, J. C. 635.31

The cultivation of asparagus.

J. Minist. Agric. Lond., 1936, 43 : 241-4.

A description is given of the establishment of an asparagus plantation on the Kirton Agricultural Institute farm in Lincolnshire on a modified American single row culture method. The operations described are :—*Formation of seed bed and sowing* ; *preparation of land for planting* (drainage, dragging, harrowing, ridging and levelling every other row) ; *selection of roots* (since this layout, experiments under American conditions proving that male plants produce heavier crops than female have been confirmed for English conditions, but at the time of planting sex selection was not thought desirable) ; *planting* (15 in. apart in rows 4 ft. 6 in. apart) ; *subsequent treatment*. Planting distance recommended in America is 8 ft. between rows. Here, although the soil is amply fertile to support the plants at 4 ft. 6 in. only, it was found that not only do the roots at this distance grow into the centre of the inter-row, but also it is difficult to get enough soil to produce the requisite length of white asparagus. Six feet between rows is suggested as a more suitable distance. The trial would appear to be an economic success judging from the costs given and a note of returns.

114. BECKER-DILLINGEN, J. 635.34-1.83

Untersuchungen über das Kalibedürfnis der Kohlarten. (Investigation of

potash requirement of different types of cabbage.)

Ernähr. Pfl., 1936, 32 : 313-8.

Results of analyses at Darmstadt show that very large amounts of K₂O are removed from the soil by an average cabbage crop, ranging from 175 lb. by brussels sprouts to 305 lb. by ordinary cabbage. In this paper trials on a peaty, sandy soil at Luckenwalde are reported. Savoy, red and ordinary cabbage were subjected to complete fertilizer, NP, and nil treatments. A complete fertilizer more than doubled the crop in all three cases. In the case of savoy the omission of the potash was not so noticeable, but its effect on the cropping of the other two types was most marked, crops being little better than those from the nil plot. Quality tests of brussels sprouts brought out the superiority of the potassium treated sprouts both as regards ease of cooking and flavour. "Sauerkraut", moreover, made from the potash treated samples was also pronounced of better flavour and quality. Finally, samples of red cabbage from a similar trial were stored in pits on 5 November, 1935 and examined on 29 February, 1936. 89% of the heads from the complete fertilizer plot were found to be in good marketable condition as compared with only 56% from NP manured plots.

115. LENDNER, A. 635.48

La culture en Suisse de la rhubarbe officinale. (The growing of medicinal

rhubarbs in Switzerland.)

Rev. hort. suisse, 1936, 9 : 34-5.

A brief account is given of Tafel's expedition to Tibet in 1905, which had as one of its objects the collection of seed and rhizomes of the true Chinese rhubarb. As a result of various mishaps,

however, only two seeds were finally brought home to Berne. The plants arising from these seeds were at first described by Tschirch under the name *Rheum tanguticum*, but, when after 5 years they flowered and produced seed, it was found that they were hybrids, and it took a further 25 years' study of the segregates to establish that the parents were *R. palmatum* and *R. cordifolium*. The rhizomes of both these species possess contents of the medicinal drug equal to that of the better rhubarbs originating in Tibet. Trial plots of this medicinal rhubarb were established in many parts of Switzerland, notably at the experimental station at Ste-Croix, where Dr. Seeger describes its cultural requirements as follows:—In addition to altitude, the rhubarb prefers a soil which is light, moist, deep, slightly acid, and which has received heavy dressings of farmyard manure. The best method of propagation is by separating and transplanting the numerous buds which form around the old rhizomes. A fertilizer mixture of kainit, phosphates and ammonium sulphate is recommended. Two distinct forms of the rhubarb are grown at Ste-Croix, one of which provides rhizomes of excellent quality and the other rhizomes of poor quality but plants of considerable ornamental value. Rhubarb leaves should never be used for food since they contain toxic quantities of soluble oxalates. The content of oxalates increases greatly towards evening, and even in the case of the petioles it is recommended that they should be cut only early in the morning. In so far as the growing of rhubarbs for the production of drugs is concerned, the low price of imported Chinese rhizomes makes it commercially impracticable at present to cultivate the crop in Switzerland.

116. FAIRBANK, H.

635.52 : 631.544

The cultivation of winter lettuce.*J. Minist. Agric. Lond.*, 1936, 43 : 453-6.

Trials were made with two varieties, Loos Tennis Ball and Cheshunt Early Giant under glass in the winter of 1935/6. Planting was done in rows 12 in. apart with 10 in. between plants, early in November. A temperature of 45-55° was maintained as far as possible. Watering was not done once a week during December and January and rather prostrate, flabby, slow growing plants resulted. With a renewal of weekly waterings in February an immediate improvement in growth and appearance was seen. Cheshunt Early Giant started to heart in February and both varieties were cleared to make room for tomatoes. Although the heads of Cheshunt Early Giant were not so large as those of the imported lettuce and weighed less, their general consistency was better and the trial has shown the possibility of growing this variety successfully in winter under glass, provided that the following points are observed:—control of *Botrytis*, maintenance of a light buoyant atmosphere, ample ventilation and plentiful water supply.

117. WOODMAN, R. M.

635.52 : 581.084.1 : 631.85

Pure silica sand as a basis for phosphate deficiency tests on lettuce.*Sands, Clays & Min.*, 1936, 3 : 1 : 22-7, bibl. 4.

A small-grained, white sand of approximately 99.8% silica content has proved very suitable for pot culture experiments with lettuces at Cambridge. The apparent density of the sand was 1.6 g. per c.c., the true density 2.63 g. per c.c., and the pore space 39.2%. Grain size as determined by I.M.M. sieves is indicated in a table. Eight solutions were used as culture media with the object of determining the responses of lettuces to different amounts of phosphorus. The form of phosphorus used was anhydrous disodium phosphate at concentrations from nil to 0.020%, the quantity of sodium being kept constant by additions of sodium sulphate. Six of the treatments consisted of full nutrient except for varying amounts of P_2O_5 , one consisted of P_2O_5 alone, and one of distilled water. The pots were housed in a greenhouse maintained as nearly as possible at 50°F. The lettuce variety was May King, and seeds were sown on 6 February in sand saturated with the culture media. Frequent observations were made and are presented in the form of a diary written at approximately weekly intervals from the time of germination onwards. Seedlings in media entirely deficient in P_2O_5 or consisting of P_2O_5 solution alone were darker green than those receiving full nutrient. In general, absence of P_2O_5 resulted ultimately in stunted plants with bronzed leaves and red or crimson stalks. P_2O_5

alone produced characteristic purple (and/or bronze) and apple-green, flat, stunted rosettes with broad, non-crinkly leaves, and red stalks. Water alone resulted in stunted, straggly, purple plants with relatively long crimson stalks. The medium containing the greatest concentration of P_2O_5 was the best of those used, giving the best growth, tender leaves of the best colour and early maturity as shown by hearting. Plants receiving smaller amounts of P_2O_5 were at first of normal colour, but later purple blotches appeared on the leaves, the intensity of the purpling becoming greater as the amount of P_2O_5 in the medium was diminished. Another symptom of an inadequate supply of P_2O_5 was the increased toughness of the leaves.

118. WILSON, A. R. 632.482 : 635.61

The chocolate spot disease of broad and field beans.

J. Minist. Agric. Lond., 1937, 43 : 1047-9, bibl. 4.

It has finally been determined that *Botrytis cinerea* Pers. is responsible for this disease. No satisfactory control has, as yet, been discovered, but its chances of assuming epidemic proportions are reduced, if care is taken to correct potash and phosphate deficiency, sour soil and poor drainage.

119. HUELSEN, W. A. 635.64

Growing tomatoes in Illinois. Problems in producing for market and canning.

Circ. Ill. agric. Exp. Sta., 451, 1936, pp. 28, bibl. 21.

The headings of the principal sections are :—Difficulties of growing tomatoes as a prairie farm crop ; fertilizers ; soil preparation ; raising, handling and setting plants ; cultivation ; staking and pruning ; harvesting and grading ; and varieties for use in Illinois. The acreage of tomatoes grown for canning has increased enormously in Illinois during the past three years. The area in question is subject to several unfavourable conditions which do not exist to any great extent in regions situated to the east where most of the experimental work has been done. These conditions, which are discussed in the first section, are :—(1) Great fluctuations in temperature, with recurrent hot winds accompanied by low humidity. It is suggested that blossom drop caused by this condition might be prevented by combining windbreak protection with irrigation. (2) Drought during the growing season. The selection of early varieties and the use of any means to promote early fruit setting, such as fertilizing, and the use of vigorous well-grown plants are suggested. (3) The dark-coloured prairie soils, typical of much of the area, are high in organic matter and comparatively high in available nitrogen and promote too vigorous vine growth. These should be avoided, except, perhaps, where they are eroded and the lighter-coloured subsoil is left largely exposed. (4) Comparatively slow drainage in some parts makes it inadvisable to grow tomatoes in heavy clay soils, since crop failure is almost certain except in years of extreme drought.

120. HADFIELD, J. W., AND CALDER, R. A. 635.64-1.523

Commercialization of hybrid-vigour in the tomato.

N.Z. J. Agric., 1936, 53 : 139-46.

The trials discussed were carried out at the Research Station, Palmerston North, N.Z., with 4 tomato varieties, Large Red, Early Cluster, Kondine and Sunrise. The varieties were crossed one with another both ways and thereafter the resulting plants were treated as in commercial practice. With certain of the crosses a higher yield was obtained than with either parent, and failing that, the trend is towards the higher yielding parent. Certain crosses gave an earlier maturity or, failing that, a trend towards the earlier maturing parents. The increased yield and earlier maturity obtained in some cases appears to warrant the cost of producing hybrid seed for commercial purposes. Crosses between dissimilar varieties seem to result in greater measure of benefit than between varieties of greater similarity. This trial having shown the possibilities of the utilization of hybrid vigour the next step will be to consider those varieties which, when combined, result in the greatest measure of benefit.

121. HUELSEN, W. A. 635.64
New wilt-resistant tomato varieties for field and greenhouse.
Circ. Ill. agric. Exp. Sta., 448, 1936, pp. 20.

Three new field varieties of tomato resistant to *Fusarium* wilt have been raised by the Illinois Agricultural Experiment Station, and released to the public under the names Prairiana, Early Baltimore, and Illinois Pride. Five wilt-resistant greenhouse varieties, Blair Forcing, Sureset Forcing, Urbana Forcing, Lloyd Forcing and Long Calyx Forcing have been similarly raised and released. In this paper the origin, vine type and fruits (with photographs) are described, and yields obtained in trials with standard varieties are noted.

122. PEARSE, H. L. 577.15.04. 635.64
The effect of phenylacetic acid and of indolebutyric acid on the growth of tomato plants.
J. Pomol., 1937, 14 : 365-75, bibl. 8.

The author records a new method of applying growth substances, namely spraying the aerial parts on several occasions with weak solutions. The 0.1% solutions of the two substances were prepared by dissolving them in 2 or 3 c.c. of alcohol and making up to the required volume with tap water. Four separate experiments were made. (1) The effect of spraying with phenylacetic acid. Of 20 young tomato plants, each in its fourth leaf and as uniform as possible, 10 were sprayed daily with 0.1% phenylacetic acid solution while the other 10 were sprayed with the same amount of tap water and alcohol without the acid. (2) The effect of spraying once weekly with phenylacetic acid. Four plants were sprayed on the first and seventh days with the above solution and 4 with tap water and alcohol. The plants were examined on the fourteenth day. (3) The effect of varying the concentration of phenylacetic acid. Here the concentrations used were 0.5%, 0.25%, 0.125%, and 0.0625%. Tap water was used as control. Eight plants were sprayed daily with each solution and 2 plants of each batch were put in a moist frame to encourage the production of adventitious roots. Three plants from each group were harvested on the seventh and 3 on the fourteenth day. (4) The effect of spraying with indolebutyric acid. Six plants were sprayed daily with a 0.1% indolebutyric acid solution and 6 with tap water. The author summarizes as follows:—" . . . Epinasty of the leaves, swelling of the stems and petioles and initiation of roots on the stems were obtained by this method, i.e. results similar to those obtained by other workers who applied these substances locally (dissolved in lanolin) or supplied them in aqueous solutions to the soil. A daily application for one week of either phenylacetic or indolebutyric acids caused increase in height, and increase in length of the internodes and petioles as compared with control plants similarly sprayed with tap water. In addition, it induced differential responses in various parts of the plants; with phenylacetic acid leaf and root growth was depressed, while stem and petiole growth was increased; with indolebutyric acid leaf growth was depressed, and root, stem and petiole growth was increased. Growth of the apical bud was gradually inhibited, indolebutyric acid acting rather more quickly than phenylacetic acid in this respect. With phenylacetic acid the relative amount of leaf, as dry weight, in the treated plants as compared with the controls, remained practically constant after two and three weeks' treatment when sprayed with 0.1% solution. The relative amount of stem and petiole continued to increase. The amount of root began to increase again after one week, owing to the fact that new roots were initiated at the base of the stem. The water content of the plants sprayed with phenylacetic acid and with indolebutyric acid was always greater than that of the controls."

123. DAVIS, M. B., AND HILL, H. 635.64 : 631.8
Tomatoes make known their diet needs.
 Reprint from *Better Crops with Plant Food Mag.*, [undated, early 1936], pp. 6.

The responses of tomatoes to excess and deficient supplies of the various essential elements have been studied during the past six years in pure sand cultures at the Central Experimental Farm, Ottawa, Canada. From the results obtained it has been found possible to use certain plant

symptoms as a partial guide in judging the nutrient requirements of growing plants. Symptoms due to deficiency or excess of some of the individual elements in tomato plants are here described. Emphasis is laid on the apparent close relationship between nitrogen supply and potassium in the plant and upon balanced ratios between other nutrients. Excess nitrogen symptoms were similar to deficient potash symptoms, though normally appearing later in the development of the plants, and excess phosphorus also resulted in a potassium-deficient condition. Both excess calcium and deficiency of magnesium produced similar necrotic spots on the lower leaves. It was found that in sand cultures the ratios of $N : K_2O$ and $P_2O_5 : K_2O$ should not exceed 1.5 : 1. A $N : K_2O$ ratio of 4.5 : 1 produced chlorosis and burning of the lower leaves, while with $P_2O_5 : K_2O$ a ratio of 3 : 1 depressed vigour and yields, one of 4.5 : 1 produced definite foliage injury, and one of 7.5 : 1 resulted in the death of the plants. A clear positive correlation has also been found between susceptibility to blossom-end rot and extreme vigour of the plant associated with a high supply of nitrogen. From these results it is concluded that it would appear undesirable to increase the P_2O_5 content of a fertilizer much beyond that of the K_2O , and that nitrogenous fertilizers should be restricted as far as possible to light dressings applied as the growth of the plants indicates need of nitrogen.

124. NIGHTINGALE, A. A., AND RAMSEY, G. B. 635.64 : 632.4 : 551.56

Temperature studies of some tomato pathogens.

Tech. Bull. U.S. Dep. Agric., 520, 1936, pp. 36, bibl. 21.

Studies of growth rates were made with pure cultures of nine organisms commonly found producing decay of tomato fruits during transit and storage in an attempt to determine the influences of temperature and maturity of fruits upon the development of decay after tomatoes leave the packing house. The daily diametric growth of colonies of the organisms was determined in petri-dish cultures grown on potato-dextrose agar of pH 4.7, corresponding to the average acidity of the juice of green fruits of the tomato variety employed in inoculation tests, and of pH 6.01, corresponding to the average acidity of the juice of ripe tomatoes. The plates were held at temperatures ranging from 30° to 95°F. at 5° intervals. Green and ripe fruits were also inoculated with pure cultures of the organisms and were held at temperatures ranging from 32° to 85°F. at intervals of 5°. The organisms studied were *Melanconium* sp., *Rhizoctonia Solani*, *Fusarium semitectum*, *Colletotrichum phomoides*, *Phoma destructiva*, *Cladosporium fulvum*, *Alternaria Solani*, *Alternaria tomato*, and *Pleospora Lycopersici*.

125. JOHNSON, L. R., AND THOMPSON, H. W. 635.64 : 632.651.3

Tomato sickness in Yorkshire.

J. Minist. Agric. Lond., 1936, 43 : 48-54, bibl. 7.

Cases of tomato sickness associated with eelworm attack have steadily increased in this county. The authors describe here the distribution of the eelworm concerned, the nature of the attack in the case of the tomato and control measures including replacement of soil, mercuric chloride treatment of soil and steam sterilization.

126. AINSWORTH, G. C. 635.64 : 632.8

"Bushy stunt"; a virus disease of the tomato.

J. Minist. Agric. Lond., 1936, 43 : 266-9, bibl. 3.

A full account is given of this disease of tomatoes, which was first discovered in this country in June 1935. If an epidemic occurred, it is thought that the effects would be quite as bad as those due to tomato streak virus. Although it is very probably insect borne, no vector has as yet been found. This virus cannot survive for long periods in dead plant material and could not, therefore, occur in smoking tobacco. Roguing of diseased plants and care in pruning would appear to be the only precautionary measures likely to be of much use in the light of present knowledge.

127. DUMONTHAY, J. 635.646
 Culture de l'aubergine. (The cultivation of egg-plants.)
Rev. hort. suisse, 1936, 9 : 88-91.

A good demand for the fruits of the egg-plant has encouraged Swiss market gardeners to grow the crop in recent years, and instructions are here given for its cultivation. The seed should be sown at the end of February or in early March in fairly warm beds and the plants then pricked out into pots or into beds 12 cm. apart. In early May they may be transplanted to cold frames or in late May into a warm sheltered position in the open. In frames a mixture of 3 parts compost and 1 part fresh soil is recommended. Only two plants are inserted per frame, but even then they grow so rapidly that by mid-June it is necessary to raise the lights on a special framework. In the open air a spacing of 75 or 80 cm. between plants is suggested. A dressing of semi-decomposed manure may be applied with good results during the growing season, but little or no watering is necessary until the first fruits are formed, after which abundant water should be applied if the weather is warm and dry. Pruning is essential, as with tomatoes, to restrict growth and encourage the formation of fruit of good size. 5 or 6 branches only should be left, all lateral buds being removed during the course of the summer. Each of these branches should bear on the average 2 or 3 fruits, thus giving 12 to 15 fruits per plant. The fruits should be cut before fully mature. Only two varieties of egg-plant are grown commercially, and of these the best is known as *Aubergine violette longue*. The second variety, *Aubergine violette longue hâtive*, produces less vigorous plants and smaller fruits, but is earlier in season. Two other varieties, *Aubergine blanche longue* and *A. blanche*, syn. *Plante aux oeufs*, are mentioned as being grown solely for ornamental purposes.

128. DE BUSSY, I. J. LE COSQUINO 635.652 : 632.3
 De bacterieziekte van de boon (*Phaseolus vulgaris* L.) veroorzaakt door *Pseudomonas Medicaginis* F. sp. *phaseolicola* Burk. (Bacterial disease of bean caused by *P. medicaginis* F. sp. *phaseolicola*.) [English summary 4 pp.]
 Published by de Bussy, Amsterdam, 1936, pp. 99, bibl. 138.

The author with the help of very clear illustrations describes the isolation, inoculation and identification of this fungus which has in the last few years seriously affected the bean fields of Holland. The characteristic symptoms are brown lesions on the stems and yellowish green; discoloured leaves with a mosaic pattern.

129. VINCENT, C. L. 635.656 : 664.84.656
 Growing peas for canning in Washington.
Pop. Bull. Wash. St. agric. Exp. Sta., 150, 1936, pp. 28.

Information is here supplied on the pea canning industry in Washington State, and on climatic requirements, soils, fertilizers, rotations, varieties, inoculation, sowing, cultivation, harvesting, the disposal of the vines, yields and the prices received. Notes are also included on the frozen-pea industry and the diseases and pests of peas.

130. CHAMBERLAIN, E. E. 635.656 : 632.8
 Pea-mosaic.
N.Z. J. Sci. Tech., 1936, 18 : 544-56, bibl. 14.

Pea-mosaic is a common virus disease of garden and field peas, broad beans, red clover, blue lupin and sweet peas. Host-range experiments showed that of 30 species of plants of the sub-family *Papilionaceae*, 18 species in 7 genera were susceptible. The vectors were found to be *Myzus persicae*, *Aphis rumicis*, and *Macrosiphon gei*. Artificial inoculations, especially by means of leaf rubbing, could, but with some difficulty, transmit infection. Transmission was not obtained through seed.

131. PETHYBRIDGE, G. H. 636.656 : 632.19

Marsh spot in pea seeds : is it a deficiency disease ?

J. Minist. Agric. Lond., 1936, 43 : 55-8, bibl. 5.

Certainty as to the cause of this disease does not, as yet, exist, but experiments by the author in 1935 strongly indicate that manganese deficiency may be concerned. There would appear to be similar indications from Holland also.

132. ANON. 632.78 : 635.1/3

The diamond-back moth.

Advis. Leaflet. Minist. Agric. Lond., 195, 1936* (revised), pp. 2.

The diamond-back moth, *Plutella maculipennis* Curtis, occasionally does serious damage to cabbages, turnips and other cruciferous plants. The insect and its life history are briefly described. Dusting with derris or nicotine dust immediately injury is noticed is recommended for vegetable crops. Field crops such as turnips may be dusted with lead arsenate or may be "brushed" by some home-made device such as a scuffer with twiggly bunches attached to knock many caterpillars off and cover the plants with soil dust which renders them unpalatable. Dusting affected plants with soot or a mixture of soot and lime has also given fair results.

133. HALLOCK, H. C. 632.76

Notes on biology and control of the Asiatic garden beetle.

J. econ. Ent., 1936, 29 : 348-56, bibl. 4.

The distribution of the Asiatic garden beetle in the Eastern U.S.A. is discussed, and studies on the factors influencing oviposition and larval abundance, on feeding preferences and on the control of the larvae and adults are reported. Suggested control measures are the same as those noted in abstract 134, below.

134. HALLOCK, H. C. 632.76

Life history and control of the Asiatic garden beetle.

Circ. U.S. Dep. Agric., 246, 1936† (revised), pp. 20, bibl. 3 in text.

The Asiatic garden beetle, *Autoserica castanea* Arrow., has become a pest of ornamental plants in parts of the Atlantic seaboard of the U.S., notably in suburban areas around New York City and Philadelphia. Some 80 plants upon which the adults feed are listed. They consist of ornamental shrubs and trees, bush and tree fruits, vegetables, flowering plants and weeds, favourite plants including rose, viburnum, carrot, red pepper, turnip, aster, chrysanthemum, dahlia, hemp, sunflower and ragweeds. The larvae sometimes injure turf lawns. The life history and feeding habits of the beetle are described. Control may be achieved on ornamental plants, except in cases of extreme abundance, by spraying them with 6 lb. acid lead arsenate plus 4 lb. wheat flour to 100 gall. water. The beetles may be caught in light traps, a small type using a 100-watt daylight bulb being suitable for private gardens, while a large type equipped with a G-5 mercury-vapour bulb will catch many of the insects even in brightly lighted places. Lawns may be protected by applying acid lead arsenate at the rate of 10 lb. per 1,000 sq. ft. Larval injury to strawberry plants may be largely prevented by mulching with hay or straw during the egg-laying season. It is suggested that potatoes should constitute the first crop planted in heavily infested, weedy land, which is to be brought into cultivation, since this crop does not appear to be attacked by the larvae. Two wasps, parasitic on the beetle in China and Japan, have been introduced and one of them is now established in the Philadelphia area.

135. DUDLEY, J. E., AND OTHERS. 635.656 : 632.753

Experiments with derris as a control for the pea aphid.

J. econ. Ent., 1936, 29 : 501-8.

From a large number of greenhouse and field experiments made in Wisconsin in 1935, it appears that sprays of ground derris root containing 0.0044% rotenone, or possibly lower concentrations,

* First issued 1934.

† First issued 1932.

combined with a spreader and wetting agent, give promise of effective control of the pea aphid, *Illinoia pisi* Kalt, when applied to canning-pea vines while the aphids are still present in small numbers.

FLOWER GROWING.*

136. ROBERTS, R. H., AND WILTON, O. C. 581.145.2
Phloem development and blossoming.
Science, 1936, 84 : 391-2, bibl. 4.

Phloem characteristics which have been observed to accompany blossoming in greater or less degree in a number of dicotyledonous plants, including chrysanthemum, begonia and ornamental lemon, are :—(1) Limited or slight formation of phloem cells following reduced cambial activity which precedes blossoming ; (2) small size of later formed cells ; (3) increase in cell wall thickness ; (4) increase in callose formation on sieve plates and fields ; (5) accumulation of inclusions in some cells ; and (6) mechanical compression. The effect produced by these conditions of the phloem tissue appears to resemble that produced by artificial girdling of the stem, and the authors therefore ask whether blossoming may not be the result of " natural girdling ".

137. HÜLSMANN, B. 635.938.46 : 631.35
 Die Entstehung der Jungpflanzen an Blattstecklingen von Lorraine-Begonien.
 (The development of young plants from leaf cuttings of " Lorraine " begonias.)
Gartenbauwiss., 1936, 10 : 470-7, bibl. 3.

This type of begonia originated in crosses between *Begonia socotrana* Hook and *B. Dregei* Otto and Deitr. The normal method of reproduction is by leaf cuttings. A more exact examination of the processes involved indicates that the following takes place :—After healing of the wound, roots begin to form in connexion with the vascular bundles, usually emerging from the tissues sideways. There are no ready formed shoot primordia present in the leaf stalk. Shoots generally arise from the separated portions either from the parenchyma or epidermis cells at some distance from the place of separation. The shoot develops its own roots from the axil on attaining a certain size, but often remains also connected to the old roots formed by the cutting. Whether the cutting is cut or broken off the old plant does not appear to affect the type of development in the cutting, though callusing and root formation is somewhat quicker in the broken than in the cut cutting. [Author's summary.]

138. LABORDE, J. 635.944
 L'histoire du dahlia. (History of the dahlia.)
Rev. hort. suisse, 1936, 9 : 255-65.

The author, who is president of the French dahlia society, traces the history of the dahlia from its introduction from America in 1789 up to the present day with its infinite number of forms and varieties. Photographs of the flowers of some 18 modern varieties are included [see also *J. N.Z. Inst. Hort.*, 1936, 5 : 43-51 ; *H.A.*, 6 : 2 : 355].

139. CAYEUX, H. 635.937.17 : 631.535
 Un nouveau mode de bouturage de l'hortensia. (Propagating hydrangeas by a new form of cutting.)
Rev. hort. suisse, 1936, 9 : 239-42.

The new method of raising hydrangeas from cuttings is similar to that described earlier for dahlias.† The cuttings consist of single leaves with a piece of stem and axillary bud attached. Fully developed shoots are used and are severed about $1\frac{1}{2}$ cm. above and 2 to 3 cm. below each node. Since each node bears opposite leaves, single leaf cuttings are finally obtained by dividing

* See also 4, 5.

† *Ibidem*, 1936, 9 : 9-12, *H.A.*, 1936, 6 : 1 : 125.

each section of stem longitudinally. In the case of the larger leaves about one-third may be cut from the tip end to reduce transpiration losses. The cuttings may either be placed, four at a time, in 7 cm. pots or on greenhouse benches in pure, sterilized sand, so that the sand completely covers the base of the petioles. A temperature of 15 to 18°C. is maintained. During the first few days care should be taken not to apply more water than is necessary to prevent wilting. Subsequently the plants may receive frequent syringings, which favour root production. Under suitable temperature conditions rooting occurs after about 3 weeks, and when rooted the cuttings are transferred singly to 7 cm. pots containing a mixture of peat mould, leaf mould and sand. The axillary buds rapidly develop into shoots, and the mother leaf at the base finally dies. From this stage onwards the plants may be treated in exactly the same manner as rooted stem cuttings. In conclusion, it is held that this new method is well adapted to common usage, especially where large numbers of plants are required. From 3 to 5 times as many plants can be raised in this way as by ordinary cutting methods, and it is therefore of particular value for multiplying new varieties quickly.

140. LE GRAVEREND, E. 612.014.44 : 635.939.98
 Le photopériodisme chez le chrysanthème. (*Photoperiodism in the chrysanthemum.*)
Rev. hort. suisse, 1936, 9 : 29-30.

The chrysanthemum variety Antoinette Bouveau normally starts to flower at Rouen about 10 November. In an attempt to discover whether early flowering might be induced by reducing the number of hours of daylight as had been found in the U.S.A., 3 plants growing near the middle of a row of 40 were covered with black satin supported on a wire frame for all but 8 hours of the day. The treatment was continued from 1 August to 20 August, by which time the plants possessed stiffer, darker green foliage and much larger flower buds than did the control plants. By 25 October the plants which had been shaded were in full bloom, whereas the untreated plants did not reach this state until 4 to 5 weeks later.

141. HILL, H., AND DAVIS, M. B. 635.939.98
Chrysanthemums thrive in sand cultures.

Reprint from *Better Crops with Plant Food Mag.*, [undated, late 1936], pp. 6.

Sufficient knowledge has been accumulated from several years' nutritional experiments to make possible the growing on a commercial scale of chrysanthemums in pure sand cultures supplied with nutrient solutions. The advantages of this method over cultivation in ordinary greenhouse soils include greater control of nutrition and, in all probability, elimination of the need for changing the soil in the beds after growing one or two crops. Leaf symptoms due to deficiency or excess of particular nutrients are described. The number and size of blooms was also markedly affected. High N combined with high K₂O gave the largest number and also the largest size of blooms. Excess P₂O₅ even in the presence of ample N and K₂O resulted in a marked decrease in the number of blooms and to some extent in their size. Deficiency of any of the three constituents greatly reduced the number of blooms, and deficiency in K₂O or P₂O₅ also markedly reduced their size. An outstanding feature of the experiments was that the colour of the flowers in two varieties was altered by excessive or deficient supplies of these elements. The nutrient solution used to raise chrysanthemums successfully to maturity in pure sand consisted of the following compounds dissolved in 50 gall. water:—magnesium sulphate 247.2 g. or 8.7 oz. approx., potassium phosphate 134.5 g. or 4.75 oz., calcium chloride 255 g. or 9.7 oz., potassium nitrate 300.6 g. or 10.5 oz., and ammonium nitrate 675 g. or 23.75 oz. A few drops of a 1% solution of ferric chloride may be added, if yellowing of the foliage indicates that iron is needed. The nutrient solution should be applied at the rate of about $\frac{3}{4}$ pint per plant or about 1 gall. per square yard per week till the plants are about half grown, and thereafter at double this rate. Good results have also been obtained with plants supplied with nutrients in solid form and a fertilizer formula which has proved satisfactory is also given. [Persons obtaining this reprint might note that the pages are not in their correct order.—ED.]

142. MILES, H. W. 635.939.98 : 632.77

The chrysanthemum leaf miner and its control.

J. Minist. Agric. Lond., 1936, 43 : 256-61.

An account is given of the life history and damage done by *Phytomyza atricornis*, the chrysanthemum leaf miner (fly). Routine spraying with nicotine at intervals of not more than 10 days appears to afford good control while nicotine dust and sulphur are found valuable for keeping the insect in check under extensive conditions, where spraying may be inconvenient.

143. WERCKMEISTER, P. 635.937.9

Über Herstellung und künstliche Aufzucht von Bastarden der Gattung *Iris*.

(The raising of iris hybrids.)

Gartenbauwiss., 1936, 10 : 500-20, bibl. 18.

Raising hybrids of garden irises is initially difficult owing to the small percentage of seeds which germinate. Lack of germination is due to faulty endosperm formation. The abnormal seeds are typical of crosses between plants of such different groups as the diploid *pallida-variegata* group and the polyploid *macrantha* group on the one hand and those of the *pallida-variegata* group and the early flowering *Chamaeiris* varieties on the other. Ordinary sowing of the seed gives very few successes, but the author describes a method whereby a good percentage of the seed from such crosses was made to germinate and in fact produce flowering plants a year or more earlier than ordinary viable iris seed. It consisted of removal of the embryo and growth in culture solution.

144. CHOUET, E. 635.937.9

Iris bulbeux pour la fleur coupée. (Bulbous irises for use as cut flowers.)

Rev. hort. suisse, 1936, 9 : 242-4.

Short descriptions, with illustrations of the flowers, are given of three types of bulbous iris, namely *Iris xiphium* (syn. *I. hispanica*), *I. hollandia*, a selection from the first species, and *I. xiphioides* (syn. *I. anglica*). The first and third in particular produce flowers well suited for cutting. Five varieties of each species growing at Geneva are listed together with their flower colours and the dates upon which they start to flower. The bulbs are planted in October to November, preferably in a rather light soil in a warm situation, and a covering of leaves should be added to protect them against hard frosts.

145. VAN DER MEULEN, A., AND LUYTEN, I. 635.937.9

Vergelijking der jonge organen van spaansche, engelsche en hollandsche irissen: (A comparison of the young organs of Spanish, English and Dutch irises.) [English summary 1 p.]

Meded. Lab. Pl. Physiol. Wageningen, 40, 1936, pp. 11.

The authors record their minute observations made on the bulbs of these three species of iris and on the gradual development of flower primordia and flowers. It is seen how the different phenomena can be correlated with the different times of flowering in the three cases. The effect of temperature on these dates is discussed.

146. BLAAUW, A. H., AND OTHERS. 635.937.9

Snelle bloei van hollandsche irissen. I. (Accelerating flowering in Dutch irises. I.) [English summary 2 pp.]

Meded. Lab. Pl. Physiol. Wageningen, 48, 1936, pp. 9, bibl. 3.

Irises of the *Xiphium* section, especially the newer group of Dutch irises, differ essentially from hyacinth, tulip and narcissus in their mode of development in that they do not show any trace of flower formation even by the end of October if dug in August. Experiments are still in progress on the best methods of ensuring early flowering the following year. At present the recommendation is to remove in August and expose to a temperature of 28° to 31°C. for one week. Then plant at 9°C. and, when upwards of 6 cm. of foliage is visible or a little later, force at 15°C. in the light.

147. NELSON, R. H. 635.944 : 632.73
Cold storage as a control for gladiolus thrips.
J. econ. Ent., 1936, **29** : 389-93, bibl. 5.

Experiments during two winters have shown that all stages of the gladiolus thrips, *Taeniothrips gladioli*, can be completely eliminated by storing infested corms at a constant temperature of 36°F. for 2 months or 40°F. for 3 months. Storage at 30°F. for shorter periods was equally effective, but ruined a large proportion of the corms. This method of thrips control in storage is held to show promise of being commercially practical.

148. HADORN, C. 632.73 : 635.1/7 + 635.9
La lutte contre les thrips dans les cultures horticoles et maraîchères. (Control of thrips on flowering plants and vegetables.)
Rev. hort. suisse, 1936, **9** : 76-80 and 102-3.

The form of injury caused by several species of thrips on a number of flowering plants and vegetables is described and illustrated by photographs. The general habit of adult thrips of retiring into the soil except when feeding or reproducing makes common spraying treatments largely ineffective, and similarly nicotine fumigation at normal concentrations only exerts effective control if repeated frequently, owing to the relatively high resistance of the adults to this substance. Numerous experiments have shown, however, that insecticides with a rotenone base will control thrips. Two products are here recommended. One, a liquid called *Déril*, has given good control of thrips under glass, when applied at a concentration of 0.3% to both the aerial parts of the plants and to the soil in pots, etc. A second application 10-15 days later is necessary, since it does not destroy the eggs. The second product is a combined insecticide-fungicide dust called *Pirox*, which is particularly recommended where thrips occur on plants in the open. Its action is mainly preventive, and if applied regularly, finely and evenly at intervals of 8-10 days it will stop the thrips entering flower buds. It may similarly be used as a preventive in glasshouses.

149. WYMAN, D. 634.972.1
Growth experiments with pin oaks which are growing under lawn conditions.
Bull. Cornell agric. Exp. Sta., **646**, 1936, pp. 23, bibl. 22.

A series of experiments was started in 1930 with pin oaks (*Quercus palustris* L.) on two different soil types in order to determine treatments which would increase the vegetative growth of shade trees. The experiments and the results obtained were as follows :—(1) *Time of planting*. Twice as many trees were injured or killed when 5-year-old pin oaks were transplanted to permanent positions in the autumn as in the spring, despite the fact that the summer following transplanting was unusually dry. (2) *Method of planting*. Careful planting in a large hole with the soil firmed, but not rammed, around the roots resulted in less injury in the first year than planting in shallow holes with the soil rammed about the roots or than planting in large, deep holes with the soil merely thrown loosely about the roots. Differences in growth of the trees planted in different ways were not, however, apparent after the third year. (3) *Initial pruning*. There was a high mortality among trees left unpruned at planting time. Pruning so as to leave the trunks of the young trees clean of branches with the exception of a few branches at the top resulted in significantly less growth than did leaving a similar quantity of branches distributed all along the trunk. (4) *Fertilizing*. Following planting of the trees the area was sown to Kentucky blue grass, and the resulting lawn was kept closely cut for the next five years, during which records of tree performance were taken. Applications of ammonium sulphate as high as 50 lb. per 1,000 sq. ft. did not injure the lawn on clay soil when made before the grass started to grow in the spring. Greater tree growth resulted from applications of nitrogen and phosphorus in the form of ammo-phos than from applications of ammonium sulphate. When, however, 8 oz. ammonium sulphate or an equivalent amount of ammo-phos were applied in holes in early May to young pin oaks with a trunk diameter of about 0.5 in., a number of trees were killed outright. On the other hand trees that were not injured from a May application of 8 oz. made as much growth during the following three years as did trees which received three separate

applications of 8 oz. in May. Fertilizers also normally produced greater secondary growth, i.e. growth between 20 June and 15 July, than was the case in check trees which received no fertilizer. (5) *General observations.* Deficient rainfall especially during the growing season materially reduced growth increments. The trees exhibited considerable variation in growth; in a group of trees, all receiving the same treatment, those which grew the most in one season did not necessarily grow the most in the next.

CITRUS AND SUB-TROPICALS.

150. PARSONS, T. H. 634.3

The cultivation of citrus with further suggestions for its improvement.

Trop. Agriculturist, 1936, 87 : 133-55.

The paper is concerned entirely with the planting of citrus in Ceylon and the instructions for cultivation given are the usual routine methods adapted to local conditions. There is some discussion on the suitability of various rootstocks. For low- and mid-country districts where conditions are moist, the sour orange and pumelo rootstocks are recommended. [It is not explained whether the author's pumelo is the pomelo (grapefruit) or pummelo (shaddock).—ED.] For up-country moist and semi-dry regions the sour orange, and for the low country regions proper, especially if under irrigation, the rough lemon and possibly the local lime are recommended. The indigenous *Atlantia Missionis* [*Atalantia*?—ED.] is suggested as a possibly useful low-country stock for dry districts, since it is apparently disease resistant, though the author has not had the opportunity to test it under suitable conditions.

151. LACARELLE, A., AND MIEDZYRZECKI, C. 634.31

Nouvelle contribution à l'étude du Clémentinier au Maroc. (Further studies on the Clementine orange in Morocco.)

Exp. fruitière et maraîchère, Rabat (Maroc), 1937, pp. 22.

The authors are continuing their investigations on the Clementine orange (see *H.A.*, 1936, 6 : 1 : 137). So far the sour orange would appear to be the best rootstock, though several native varieties of citrus are also under trial. The variety is found to be very susceptible to cold winds at flowering time. Although the general appearance of the Clementine is uniform, that of its fruits is not, differences in size, shape, skin, time of ripening, etc., being due partly to heredity and partly to external environmental factors. Bud selection is therefore essential. Pollination studies are in progress. Hand self-pollination results in seedless but normal sized fruits. Seedless fruits have also been the rule when Washington Navel, Thompson Navel, lemon and to a certain extent Jaffas are planted close at hand, but the planting of Duncan and Triumph grapefruit nearby has resulted in seeded fruits. The effect of planting Marsh Seedless is not yet known.

152. RICHARDS, A. V. 634.3-1.53

The propagation of citrus.

Trop. Agriculturist, 1936, 87 : 269-80, bibl. 8.

The propagation of citrus is discussed chiefly from the point of view of obtaining clonal material, either as rootstocks or own root plants. No fresh ground is broken in the general discussion, but in regard to the technique of vegetative propagation the author's experiences are worth noting. Although nearly all varieties of citron, lemon and lime will root in the open from cuttings with or without leaves, oranges, grapefruit and mandarins require special conditions of foliage, bottom heat and humidity to ensure success. The proper environment can be provided by the use of a solar propagator which is briefly described and follows the usual lines. The rooting bed in the propagator is formed by a sheet of expanded metal on which in turn is laid wire netting, coconut fibre and well washed coarse sand to a total depth of 6-8 in., fine sand being liable to become too saturated with the moisture from the exposed water surface in the tank. The rooting bed is lightly sprinkled with water early each morning and is thereafter

kept closed and lightly shaded. To ensure that the leaves of the more difficult varieties maintain their turgidity—since, if they drop, the cuttings will not root—careful control has to be exercised in maintaining sufficient but not excessive moisture in rooting medium and air. The most successful are soft wood cuttings (really semi-hard in texture) 8-10 in. long, and having 4 or 5 leaves in which the dark green colour is fully developed. Grapefruit cuttings which lost their leaves in the propagating frame decayed without rooting. Leafless grapefruit cuttings first splice-grafted to leafy nattaran (*C. medica* var.) scions usually produced roots and, when later planted out, the grapefruit shoots grew away while the nurse scion remained dormant. The further application of this principle to difficult citrus varieties is under trial at the Experiment Station, Peradeniya, Ceylon. The nattaran roots freely in the open on leafless cuttings, the roots being produced not only at the callus but also higher up the stem. Its scions also unite very easily with the stock. Nattaran cuttings have also been shield budded with grapefruit, mandarin and orange, and set in the propagator. As soon as the stocks had rooted the buds began to grow, and thus bud grafted plants were obtained in a few weeks. However, the value of the nattaran as a rootstock under local conditions is unknown at present. Grapefruits Ellen, McCarty and Triumph strike more readily than Walters and Marsh Seedless. Mandarins require more bottom heat. Certain varieties, Mongibella, Isabella, California Wonder—classed tentatively as shaddocks—imported from India, have shown a vigorous habit of growth, an appreciable resistance to canker, and strike root readily.

153. TORRES, J. P.

634.3 : 581.141

Polyembryony in citrus and study of hybrid seedlings.*Philipp. J. Agric.*, 1936, 7 : 37-58, bibl. 6.

A number of species and varieties of citrus were studied for embryo counts, for the relation between the number of embryos and the number of seedlings produced, for distinguishing characteristics in young hybrid seedlings compared with the apogamous seedlings of the same parents, and for the effect of different pollen upon percentage of hybrids produced. The embryo counts showed a striking difference between pomelo (shaddock) and grapefruit, often classified under the one species, *C. maxima* Merr., synonymous with *C. decumana* L. or *C. grandis* Osbeck. It was found that, whereas all pomeloes were uniformly mono-embryonic, the grapefruits were more or less polyembryonic. On the strength of this the author proposes the name *C. decumana* var. *ovucarpa* for grapefruit. [It should be pointed out that the grapefruit has already been given specific rank under the name *C. paradisi* Macf., which name is accepted both by the Kew Handlist and by Hume in his "Cultivation of citrus fruits".—ED.] Completely mono-embryonic forms were—all the shaddocks, one seedling sour orange tree out of 3, the carabao lime and the native Philippine lime (vars. of *C. aurantifolia*) and a wild variety of *C. hystrix*. Notes on the polyembryonic varieties studied are also given. While there was a statistically insignificant correlation between embryo counts and seedling counts, the percentage of embryo seedlings did appear to be inversely proportional to the size of the mean embryo; that is to say, the more embryos the seed contains the weaker they will be and the less their chance of successful germination. Out of 52 crosses, 14 showed strong manifestations of hybrid vigour; in 3 crosses, reciprocal between the pairs, the hybrids were weaker than the non-hybrids of either parent. The pollen variety was in some cases found to have a marked effect on the percentage of hybrid seedlings produced, compared with the percentage of apogamous seedlings from the same parent. The results are set out in a number of tables in which all crosses made are recorded.

154. HODGSON, R. W., AND OTHERS.

634.3-1.541.11

Rootstock and scion influence in citrus.*Calif. Citrogr.*, 1937, 22 : 110.

Two trifoliate orange (dwarfing) and two rough lemon trees (vigorous), grown from apogamic seedlings, were self- and reciprocally budded, making four combinations in all. In the self-budded trees the buds were inserted in the stem of the tree from which they were taken. At

the end of the seventh growth season one tree of each combination was dug out as completely as possible and recorded photographically, measured, and the dry weights of rootstock and scion taken. Using the tree budded to itself as a standard of comparison, scion influence was apparent in each of the cross buddings. The rough lemon scion had noticeably invigorated the trifoliate rootstock, while conversely the trifoliate scion had markedly dwarfed the rough lemon stock. In each case the scion and rootstock growth of the reciprocal combinations was intermediate between the growth of the two species budded on themselves, which indicated that, while the scion had influenced the rootstock, the stock had also influenced the scion.

155. MENDEL, K.

634.3 : 631.541.5

The anatomy and histology of the bud-union in citrus.

Palestine J. Bot. hort. Sci., 1936, 1 : 2 : 13-46, bibl. 72, reprinted as *Bull.*

Rehovoth agric. Exp. Sta., 19, 1936.

Although the general process of union in grafts is fundamentally the same in all species of plants, it is considered that every genus presents specific problems and that the healing of graft unions should be considered separately for each species or group of related plants. In the case of *Citrus* no work on the anatomy of the graft union had previously been published, and the detailed study reported here was, therefore, undertaken to determine the nature of the processes of union. The material consisted principally of sweet lime stocks budded in the autumn with Shamouti (Jaffa) orange buds "without wood", i.e. without any of the original xylem tissue in the centre of the shield. This method is in conformity with general practice in Palestine. The processes of union are described and illustrated in detail and are discussed at length in relation to the processes noted by workers elsewhere with other plants. The stages of development of the union and the approximate times after budding at which they were manifested were as follows :—First cell division 24 hours ; first callus bridge 5 days ; differentiation in the callus of the bark flaps 10 days, and in the callus of the shield 15 days ; first occurrence of meristematic layers in the callus between shield and bark flaps 15 days ; first occurrence of tracheids in the callus of the bark flaps 15 days, and in the callus of the shield 20 days ; lignification of the callus completed in the bark flaps in 25-30 days, and under the shield in 30-45 days. Callus formation begins almost simultaneously in all tissues adjacent to the wound, being most marked in the wood of the rootstock, less so in the raised bark flaps, and least underneath the bud of the shield. Wound gum is formed as a secondary process in discontinuous layers from cells destroyed by the pressure of the two calluses growing together, and does not form initially at the surfaces of the wound or the callus, nor frequently where the medullary rays pass through the callus. Lignification occurs gradually in the course of differentiation except in a small area under the bud, which, as a "basal pith plate", initiates the pith cylinder of the scion. Differentiation of the cambium begins near the outer edge of the callus formed by the raised flaps and develops to unite with the cambium at the edge of the shield. In addition to the union of the Shamouti with sweet lime a study was made of the union of the Shamouti with sour orange. No fundamental anatomical differences were observed between the two unions. The investigation has also shown that the older wood and pith of these citrus varieties are incapable of regeneration. Thus, if the central core of wood in the shield is not removed, the shield has to be cut very thin to allow callus to form on the entire cut surface. From a practical standpoint, however, the budding of citrus should be done "without wood". Finally, an examination of the sprouting of buds inserted in the spring indicates that the periods occupied by them in the stages of union must be shorter than those given above for autumn-budded material.

156. HAAS, A. R. C.

634.3-2.112

Mesophyll collapse of citrus leaves.

Calif. Citrogr., 1937, 22 : 114.

The name "mesophyll collapse" is proposed for a physiological disease of orange and lemon in which areas between the leaf veins turn yellowish, appear slightly shrunken when viewed from the lower surface, and in severe cases turn brown, involving and killing the tissues on both the

upper and lower surfaces. If the attack is slight, the affected leaves remain on the trees, and in that case the injury is equivalent to the reduction in active food making leaf surface. The internal structure of the leaf and the effect of the disease on it are described and illustrated. The cause of the disease is associated with an inadequate water supply and a number of possible factors which might bring this about are recited. The author mentions that in unreported results he has been able to reproduce this injury by drying soils in citrus cultures to various degrees before applying water.

157. HAAS, A. R. C. 634.3 : 581.192 : 631.83
Potassium in citrus leaves and fruits.
Calif. Citrogr., 1937, 22 : 154, 156, bibl. 9.

Study of the potassium content of leaves and fruit of citrus suggest that while it is difficult to give any definite answer in the case of leaves, potassium in the fruit is increased by potassium fertilization of the soil. Whether the quality of the fruit is affected is uncertain.

158. PILLSBURY, A. F., AND COMPTON, O. C. 681 : 634.3
A fruit circumer.
Calif. Citrogr., 1937, 22 : 151, 156.

A circumference gauge for measuring fruit, called a "circumer", combining the features of cheapness, accuracy and convenience, has recently been devised by the authors at the Citrus Experiment Station, Riverside, California. It is claimed that it is more accurate than calipers on fruits that are not round and quicker than plain tape measurements on all fruits. It can be used with one hand and measurements made very rapidly. Scale working drawings are given.

159. ANON. 634.3 : 581.192
X-ray machine shows inside characters of citrus fruits.
Calif. Citrogr., 1937, 22 : 142.

A general description of a newly invented device whereby citrus fruits may be examined by X-ray as they pass along a conveyor belt, and unsound fruit ejected. Good fruit with heavy juice appears dark on the screen, immature fruit, fruit low in sugars, frozen or granulated shows up light. Any condition causing a breakdown of the cells of the fruit is visible on the fluorescent screen. Internal decline of lemons can be observed but not *Alternaria* rot. The machine is a production of the General Electric Corporation of Chicago. It is still in the experimental stage.

160. ELAZARI-VOLCANI, T. 634.3-1.542 : 581.11
The influence of a partial interruption of the transpiration stream by root pruning and stem incisions on the turgor of citrus trees.
Palestine J. Bot. hort. Sci., 1936, 1 : 2 : 9-6.

Various forms of root pruning and stem incisions were applied to citrus trees of several species in order to determine what proportion of the water-conducting tissue must be present to prevent wilting of the leaves. The treatments were applied in October during a period in which maximum temperatures ranged from 29 to 31°C. and relative humidities were rather high. Baladi [a native sweet orange—Ed.] and Shamouti (Jaffa) oranges (both *C. sinensis*), sweet lime (*C. aurantifolia* var. *dulcis*), sour lemon (*C. Limonia*), and a citron (*C. medica*) were used in the trials. The results appear to indicate (1) that more than one-half of the cross section of either the root system or the stem may be interrupted without severe wilting and injury to young citrus trees; (2) that the central part of the stem in sweet orange and sweet lime can function quite efficiently for the conduction of water; (3) that the vessels on one side of the stem and of the root system can provide the foliage on the opposite side of the tree with water; and (4) that when cuts are made on opposite sides, one above the other, water conduction will follow a zigzag course without marked restriction unless the cuts are made only a short distance apart.

161. HYATT, J. B. 634.323 : 581.192

Some chemical characteristics of New Zealand grapefruit.

N.Z. J. Sci. Tech., 1936, 18 : 409-18, bibl. 7.

New Zealand grapefruit is a selected strain of a local variety known as Morrison's Seedless. With a view to ensuring its best development its characteristics should be known by those concerned with the citrus industry. This paper reports the first of a series of investigations which are to extend over several years. Present results indicate that :—The palatability of the fruit increases with the figure for soluble solids (Brix)/acid ratio and that 5.0 is the lowest that should be accepted for table use. The sugar/acid ratio gives a better index of fruit quality than the soluble solids (Brix)/acid ratio, but the latter is more readily determined. The percentage of pectin permits of marmalade manufacture. The ascorbic acid (vitamin C) content is equal to that of grapefruit from elsewhere.

162. HAAS, A. R. C. 634.3-1.83 : 581.143

The growth of citrus in relation to potassium.

Calif. Citrogr., 1936, 22 : 6, 17, 54, 62, bibl. 6.

1. *Potassium deficiency symptoms in leaves and fruits of trees grown in sand cultures.* Potassium deficiency in pot-culture experiments with citrus produced the following symptoms. With Valencia oranges a permanent wilting of the leaves and the development of yellow patches—afterwards turning brown—combined with the production of rough resinous spots on both sides, the latter symptom being most pronounced when calcium was substituted for potassium and to a lesser extent when sodium or magnesium were substituted. With lemons the same treatment produced a yellowing or bronzing of parts of the leaf, differing from the uniform yellowish green of nitrogen deficiency. With the advent of new growth the old leaves started to scorch near the tip, being thus distinguishable from chlorine scorch which starts at the tip. With grapefruit the leaves became yellowish-green and developed similar brownish gum deposits. Increase of the calcium content of culture solutions made it proportionately more difficult for the plant to obtain sufficient potassium from a given concentration of this constituent. The effect of potassium deficiency on the fruit is little understood. Illustrations are given of fruit injured by this deficiency, but it is stated that this is a subject on which much information is still needed. It was noticed that very little fruit was held on affected trees. 2. *Gum formation as a consequence of potassium deficiency.* Gum, which term here includes mucilaginous and resinous materials, in the absence of potassium not only appears on the surface but infiltrates into the tissues. Lemon leaves, cross sectioned, show long, narrow, palisade cells, but in the case of certain deficiencies, including potassium, these become nearly square. Valencia and grapefruit trees well supplied with potassium exuded no gum after cuts had been made in the trunks, whereas potassium deficient trees exuded copiously after 24 hours. Potassium deficient trees were severely injured by a dry north wind and accumulated much dry gum in the bark on the injured side. 3. *Potassium deficiency and potassium requirements in solution cultures.* Rooted lemon leafy twig cuttings in potassium-deficient solutions became yellow in leaf with resinous deposits in the veins and the new leaves were small. Ultimately leaves became permanently wilted and, together with the young twigs, died. The roots were dark coloured with short enlarged stubby laterals and were marked with brown zones. A low concentration of potassium, 0.75 per million, was sufficient to maintain a healthy growth of lemon cuttings, though in the controls 185 parts per million were actually used.

163. TORRES, J. P. 634.31 : 631.83 + 631.84

A progress report on the effects of nitrophoska fertilizer on old Batangas mandarin orchards.

Philipp. J. Agric., 1936, 7 : 193-204.

Nitrophoska is a complete fertilizer containing 15% nitrogen, 11% water-soluble acid phosphate and 26.5% soluble potash. The trees used were Batangas mandarins, 25 years old, in a very poor condition owing to neglect. The experiment began in 1933 after the orchard had changed hands and the trees had been cleaned up, the ground lightly ploughed and planted with *Leucaena*

glauca as a permanent cover crop. The soil was a light porous loam. Application of the manure was made annually at the rate of 2 kg. and 3 kg. per tree. Good effects with the 2 kg. applications did not appear until the third year, but the 3 kg. rate produced earlier results, though in neither case was the average increase in yield very substantial. It was found, however, that vigorous shoots were produced from the trunks and main branches of the manured trees. These were budded with more productive varieties and yielded well within 2 or 3 years.

164. WERBER, A.

631.67 : 631.453

Is irrigation with saline water possible ?*Hadar*, 1936, 9 : 201-3.

Certain soils can stand irrigation with water containing a certain amount of salt without producing adverse symptoms in plants. These tests were undertaken to ascertain the extent of the absorptive capacity of the soil under Palestine irrigation practices and whether it would be possible to remove by technical means the salts absorbed by the soil. The method used consisted in passing given quantities of water of known chlorine content through a block of light soil taken from a representative orchard. The following conclusions were reached :—A given variety of soil cannot indefinitely absorb salts ; following the percolation of a certain amount of water with a given chlorine content a point of satiety is reached beyond which no further absorption of chlorides takes place, even if irrigation is continued with water containing the same amount of chloride as before. With the soil and water used satiety was reached with 118 g. of chlorine per 1 m³ or 0.0118% of the soil content. Such a small chlorine content is harmless to plants. It is pointed out, however, that these tests took place in a period of 48 hours, whereas irrigation continues at intervals throughout the season. The simple deduction methods used here are not sufficient to determine whether successive irrigations would bring about a change in the point of satiety. The accumulated chloride content of the soil in this experiment would be entirely leached out by an annual rainfall of 64 cm. In a later experiment with water of a higher chlorine content which gave a soil satiety of 217.6 g. per 1 m³ a similar rainfall would have removed 90% of the chlorine. The author considers his tests as only valuable in that they show the prospects of the further experimentation in this direction which is urgently needed for orchard improvement and should be carried out on a field scale.

165. PATH, J.

634.3-1.459

The terracing of slopes for citrus plantations.*Hadar*, 1936, 9 : 282-3, 285.

The need for terracing to prevent erosion and improve cultivation on hillside orange groves is pointed out. The way in which such terraces can be constructed and prepared for irrigation to the best advantage is shown. The explanations are made clear by diagrams.

166. REICHERT, I., AND PERLBERGER, J.

634.3-2.4

The prevention of diseases in citrus seedbeds.*Hadar*, 1936, 9 : 253-9, 278-81.

The most important parasitic diseases attacking citrus seedlings in Palestine are :—damping off diseases, various root diseases and stem blight. Non-parasitic diseases are numerous and due generally to environment, the most important being albinism. The symptoms of all these diseases are described. Preventive cultural measures are :—sowing in open seed beds in spring ; if winter sowing under glass-covered frames is considered necessary, the woodwork should be treated with carbolineum and the aspect should be towards the south-east or south-west ; the seed bed should be sandy clay covered with 1 cm. of pure sand ; 2-year-old manure may be incorporated. The seed should be taken only from selected fruit, removed by washing and disinfected by immersion for $\frac{1}{2}$ hour in a Ceresan solution of 1 : 1000 (1 g. per litre of water) for sweet lime and 1 : 2000 for sour orange ; sowing should be in rows 4-5 cm. apart, the seed covered with 1 cm. of gritty sand and watered as may be necessary and not at some predetermined time interval. After germination the lights must be removed daily for some hours even during rain.

General preventive measures besides disinfection of seed, are disinfection of fruit by immersion for $\frac{3}{4}$ -1 hour in Ceresan 1 : 500 ; disinfection of soil with Ceresan 1 : 5000 or formalin solution 1 : 200 at 8 litres per sq. metre ; this is repeated a second time after 48 hours, the soil being hoed and kept covered during the process ; after a further 48 hours the soil is uncovered and aired for 10 days, being hoed twice during the period ; and finally a fortnightly spraying of the seedlings with bordeaux $\frac{1}{2}\%$. An outbreak of disease is treated by a reduction of watering, increase of ventilation and a fortnightly spraying of $\frac{1}{2}$ - $\frac{3}{4}\%$ bordeaux or 1 : 3000 Ceresan solution. Albinism, in which seedlings are lacking in chlorophyll in leaves and stem, the cause being physiological but otherwise unknown, can be prevented, the author discovered, by disinfecting the seeds as described above.

167. BARNES, A. C. 634.3 : 382.6

The regulation of citrus exports.

J. Jamaica agric. Soc., 1936, 40 : 503-7.

A Citrus Export Control Board has been appointed in Jamaica to advise the Government as to the system of regulation necessary to co-ordinate exports of citrus fruits in view of the development of the industry likely to occur in the near future. The article justifies the appointment of this Board and points out the ways in which it will benefit growers, particularly in dealing with the shipping companies as a single authority on behalf of all the growers, in effecting economies in transport within the island and in the maintenance of a sufficiently high standard of production to give Jamaican fruit a recognized place in world markets.

168. REED, H. S., AND PARKER, E. R. 634.31-2.19

Specific effects of zinc applications on leaves and twigs of orange trees affected with mottle-leaf.

J. agric. Res., 1936, 53 : 395-8, bibl. in text.

Thirty-year-old orange trees, growing at Riverside, California, which had produced mottled and dwarfed leaves for many years past, were sprayed in March 1934, just before the appearance of the first growth cycle, with a mixture containing 10 lb. commercial zinc sulphate and 5 lb. hydrated lime in 100 gall. water. Improvement in the amount and character of the spring growth was observed a few weeks later and has been maintained during the two following seasons. Other trees similarly sprayed in October also showed normal growth the following spring. In addition to normal foliage colour the treated trees were found to produce larger leaves and longer internodes than untreated trees. Sections cut of twigs collected in May 1935, and representing the spring cycles for the years 1933 to 1935 inclusive, revealed that the sprayed trees had produced significantly more xylem tissue in the two older lots of twigs than had untreated trees, but that there were no significant differences in the amounts of phloem tissue formed.

169. CUPPLES, H. L., AND OTHERS. 632.752 : 632.944

Tests of possible substitutes for hydrocyanic acid in fumigation of California red scale.

J. econ. Ent., 1936, 29 : 611-8, bibl. 3.

Over 300 chemical compounds have been subjected to toxicity tests on the California red scale, *Chrysomphalus aurantii*, in an effort to find fumigants better than, or capable of improving the action of, hydrocyanic acid. The results have not been promising, but are published as a guide to future investigators. The compounds are divided into 3 groups :—(1) Those showing little or no toxicity, (2) those showing moderate toxicity or which have given inconclusive results due to severe fruit burning, and (3) those showing a substantial degree of toxicity. In each case it is noted whether the compound has been tested alone or in conjunction with HCN or in both ways. The third group contains only 16 compounds, most of which appear to cause injury to foliage, or fruit. No compound which was not toxic to the scale by itself proved very effective when used with HCN.

170. WARDLAW, C. W.

634.653 : 581.1

Notes on the physiology and biochemistry of tropical fruits. I. Avocados.*Trop. Agriculture, Trin.*, 1937, 14 : 34-41, bibl. 41.

It is stated that these notes are essentially a review of the more important literature. 1. *Composition and dietetic value.* The high oil content, 30% of fresh weight, is equalled only by that of the olive, which the expressed oil also resembles in chemical constitution. The fruit has a high calorific value and a low carbohydrate content and in the former respect its value is 3 times that of the banana. The iron content, physiologically in a highly available condition, is 3 times that of other common fruits. The vitamin A content is sufficiently high, it is said, to provide resistance against bacterial infection, a quality in which olive oil is said to be lacking. Other vitamin contents are : B abundant, C traces, D fair, E good. The percentage of mineral matter is higher than in any other fruit. The percentage of total sugars is small and mainly in the form of free reducing sugars. 2. *Fat content, race and environment.* Three avocado races are recognized, namely the Mexican, Guatemalan and West Indian. There is no absolute correlation between fat content and race, but the former appears to be influenced partly by genetic constitution and partly by climatic conditions. No direct correlation has yet been established between fat content and palatability or between fat content and sugar and protein values. 3. *Changes during development.* There is a rapid increase in fat content during the early development of the fruit, the rate of accumulation decreasing with greater maturity. Growth curves for Californian fruits show higher rates during light crop years. 4. *Chemical composition of the seed.* The principal storage material is starch, present to the extent of 29.6 per cent.* The seed is also the best known source of perseitol, a solid alcohol containing seven hydroxyl groups. 5. *Physiological diseases in their relation to growth and water economy.* The two types of physiological disease known to occur during the development of mature fruits under Californian conditions are "end-spots" in which the styler end withers, dries and cracks, and another form of end-spotting known as "speckles" in which the fruit becomes pitted with small, dark, dry, depressed spots. The cause is attributed by Haas [*Plant Physiol.*, 1936, 11 : 383-400; *H.A.*, 6 : 3 : 560] and Horne [*Bull. Calif. agric. Exp. Sta.*, 585, 1934; *H.A.*, 5 : 3 : 458] to reduced gaseous exchange due to a decrease in stomatal efficiency as the fruit approaches maturity. 6. *Picking maturity.* The problem calls for a knowledge of the changing composition of the fruit throughout its development, since value and storage qualities are affected by too early or too late picking, while at the same time the physical appearance of the fruit affords little indication of its condition. 7. *Maturity as determined by fat content and specific gravity.* The fruit is quite mature and ready for picking, with the assurance that normal ripening will follow, when the fat content has reached its maximum. The fat content has been correlated with specific gravity. For a number of Florida varieties specific gravities of 0.98 and 0.96 have been shown to be critical. 8. *Oil content by refraction methods.* The refractive index varies with the variety and the method of extraction employed. This method of determining the oil content is therefore liable to error. 9. *Picking maturity and time to ripen.* With green varieties no external characters have been found capable of indicating picking maturity. For colouring varieties in Trinidad, however, picked at the first trace of colour the author has evolved a table showing rates of ripening to "eating ripeness" in relation to storage temperature. The extremes are 80°F. 3-6 days and 40°F. 30-40 days. 10. *Critical storage temperatures.* These vary with the variety, the optimum temperature for slow ripening being 40°-50°F. With West Indian varieties cold resistance is feeble, chill effects being found in most after 20-25 days at 40°F. The genetical constitution of seedling West Indian varieties shows a considerable range of cold resistance, from chilling after 15 days at 52°F. to normal ripening during 40 days at 40°F. 11. *Changes during storage.* An increase in fat of 2% of the fresh weight has been consistently observed (increases are also observed when the data are stated on a water free basis) and are particularly noticeable when the fruits are relatively immature. 12. *Self heating in packs.* There is a tendency for the fruit to develop heat in packs, a temperature difference of 5°F. being possible in large consignments between the interior fruit and the delivery air, leading to wastage and premature ripening. Rapid cooling is desirable and heat retaining packing material should be

* Wet basis (after Weatherby).

avoided. 13. *Low temperature injury under field conditions.* Susceptibility to injury is a genetical character and may be operative for the tree, the blossom or the fruit. The fruit itself, owing to its high oil content, does not readily freeze, but the fruit stem does and subsequently breaks. Varieties combining late blooming with early maturity of fruit are the solution. There is a marked difference in frost resistance between the three races, the West Indian showing least tolerance and the Mexican most. 14. *Low temperature injury during storage.* Various manifestations of chilling in storage are described, such as necrosis of the skin (not common), discolouration of the flesh, discolouration of the normally hyaline vascular strands, in severe cases a browning of the cotyledons of the seed, impairment of palatability. The fruits are, in general, most subject to chilling during the initiation of ripening. 15. *Respiration and gas storage.* The author observed in freshly picked, full grown, firm fruits held at 70°F. a rapid rise in the output of CO₂ after 2-4 days, followed thereafter by a fall till at 8-14 days the fruits are over-ripe and probably killed by fungi. The respiration rates were 40 mg. per kg. per hour rising to 170 mg. at the climacteric peak. The possibility of preservation by a combination of refrigeration and gas storage, as also by suitable smears and wraps, is discussed in the light of data obtained during the author's experimental work.

171. TORRES, J. P. 634.653 : 581.145.1
Some notes on avocado flower.
Philipp. J. Agric., 1936, 7 : 207-27, bibl. 8.

The movements, opening and closing of flowers both in the morning and afternoon of the avocado varieties Pollock, Tertoh, Wester and others were studied. In Wester the first opening takes place in the morning and the second in the afternoon of the following day. In Pollock and Tertoh the first opening is in the afternoon and the second the next morning. The time of day of these movements is a varietal characteristic. Discharge of pollen takes place at the second opening and the period of dehiscence lasts about 4 hours, starting from very shortly to 3 hours after the opening of the flowers, according to variety. Points to observe in hybridization are given. The unwanted parts of the raceme to be pollinated should be removed 2 or 3 days before the flowers to be crossed open. Removal a day before, at the time of crossing, or a day after causes the pollinated flowers to fall a few days later. Removal 3 days after the flowers have been emasculated and cross pollinated has no ill effects. Emasculation and pollination should be done when the flower first opens, as the stigma rapidly loses receptiveness and its own anthers are still safely closed. The pollen should be gathered at least half an hour before the time of dehiscence or it may be lost. It is best collected by placing the flowers in some receptacle such as a paper bag within which the pollen will be shed. In the course of the experiments some varieties were found to be cross sterile, some compatible only in one direction, others would cross successfully either way. Among isolated, seedling avocados various degrees of fruitfulness have been observed from complete self-sterility in some to partial and full self-fertility in others.

TROPICAL CROPS.*

172. ROBERTSON, J. 631.543.82
A useful hedge plant (*Pithecolobium dulce*).
E. Afr. agric. J., 1936, 2 : 250.

This plant raised from seed sown *in situ* 4 in. apart in a single row, and refilling as necessary, has proved at the Mpanganya agricultural station, Tanganyika, completely successful against hippopotamus, wild pig, baboon and monkey, in fact against every depredator except possibly elephant and rhinoceros. Owing to its thorny trunk and branches the natives do not steal it. It seems to thrive either in dry or waterlogged soils.

* See also 14.

173. FERRIÈRE, J., AND JACQUES-FÉLIX, H. 631.615 : 633.584.9
 Le marais à *Raphia gracilis*, de Guinée française. (*Utilization of **Raphia** marshes in French Guinea.*)
Rev. Bot. appl., 1936, 16 : 105-23, bibl. 12.

An account is given of the plant ecology of low-lying lands in French Guinea for which the name "gracilo-raphiale" has been proposed from the predominant plant, the palm *Raphia gracilis*. These marshes, which were formed originally from the filling up of previously eroded hollows by the descent of soil and detritus from the surrounding high ground, are of various soil types and depths. Much information as to their nature can be gained from a study of their vegetation which varies with the type of soil. These variations and their corresponding soils and subsoils are tabulated. The marshes when drained and improved by the various methods here described make admirable agricultural and plantation lands particularly for bananas, coffee, tobacco, potatoes and rice. Much land available for this sort of treatment lies between the sea and the first high ground in French Guinea and the author urges that settlement of these lands should be hastened.

174. PAUL, W. R. C. 631.874
 The value of *Tephrosia purpurea* as a green manure in the dry zone.
Trop. Agriculturist, 1936, 87 : 176-7.

Trials with the object of finding a leguminous cover crop which will continue to grow throughout the driest weather in the dry zone in Ceylon so that the soil may be protected from the effects of high temperature showed *Tephrosia purpurea* to fulfil these conditions very successfully. It thrives on sandy soils with low moisture capacity and neither wilts nor suffers from pests or diseases even in the driest months. Seedlings grew for several months with only 1 inch of rain per month to sustain them. Pods form often within a month of germination, but growth is not thereby terminated. The plants are not usually eaten by cattle. Experiments with this plant are being continued by the Agricultural Department of Ceylon.

175. BAKER, R. E. D. 632.411
 Notes on Trinidad fungi. I. *Phytophthora*.
Trop. Agriculture, Trin., 1936, 13 : 330-2, bibl. 11.

A new strain of *Phytophthora* causing a pod rot of cacao identical with that caused by *P. palmivora* is described. It is emphasized that the strain has probably existed in Trinidad for many years and its discovery is of little economic significance in the control of cacao diseases. Brief notes are given of other *Phytophthora* species found on cacao, cotton, citrus and tobacco. [Author's summary.]

176. HAIGH, J. C. 632.51
 Notes on the water hyacinth (*Eichhornia crassipes* Solms) in Ceylon.
Ceylon J. Sci., (A)12 : 97-107, bibl. 3.

Experiments have been carried out on the production and germination of seed in the water-hyacinth (*Eichhornia crassipes* Solms) in Ceylon. The plant is a dangerous aquatic weed, blocking waterways, causing floods and interfering with cultivation. It multiplies vegetatively with great rapidity, but reproduction by seed is also known to occur. It was established that preliminary drying out of the seed is not essential to germination, and that the necessary conditions are such as are found in shallow water on the edges of lakes or tanks during periods of bright weather.

177. GARNETT, C. B. 632.951.1
 Derris root.
E. Afr. agric. J., 1936, 2 : 111-3, bibl. 9.

The article will be useful as a general and condensed reference for information on the cultivation and properties of derris. No new information is given.

178. LECOINTE, P. 632.951.1
 Les plantes à rotenone en Amazonie. (**Rotenone producing plants of the Amazon.**)
Rev. Bot. appl., 1936, 16 : 609-15.

Some account is given of the collection and processing of rotenone bearing plants in Brazil. Of these the richest in rotenone is *Lonchocarpus Nicou* (Aubl.) Benth. which may contain from 8% to 12%. *L. Urucu* Killip & South, the most widely spread, may contain from 3%-5%, while the content of *L. floribundus* Benth. is very much less; there are also other local and inferior varieties. The derris varieties found in Brazil are *D. guianensis* Benth. and *D. negrensis* Benth.; both being of considerably less value than the derris of the East Indies. Three species of *Tephrosia*, *T. nitens* Benth., *T. brevipes* Benth. and *T. toxicaria* Siv., are abundant and, in view of the remarkable activity of the extract from the leaves and seeds of *T. Vogelii* in Africa, deserve investigation. An account is given of the primitive methods of collection and preparation of these plants. The article concludes with a list of other plants of Brazil used as fish poisons but not belonging to the rotenone-containing group.

179. ODELL, F. D. 633/5 : 658.8
Market surveys of Burma crops. An introductory note.
Bull. Dep. Agric. Burma, 32, 1936, pp. 12 + xxiv.

The author states in his foreword that this paper has been prepared primarily for the information of Assistant Marketing Officers, in order to indicate the relative importance of individual commodities, both crop and livestock, on which economic surveys are now being started. Trade is considered as a whole, in connexion with particular countries, and with reference to particular agricultural products. Individual commodities are divided into two groups:—(i) "Surplus group", in which exports exceed imports, and which includes, among crops of horticultural interest, rubber and cutch; (ii) "Deficit group", in which imports exceed exports, and which includes tobacco, fruits and vegetables, betel-nut, coconuts and coconut products, groundnuts, chillies and tea. Much of the information is presented in the form of tables in the text and in numerous appendices.

180. GARRIDO, T. G., AND TORRES, J. P. 633.52
Flax in the Philippines.
Philipp. J. Agric., 1936, 7 : 229-41, bibl. 7.

In the Philippines fibre flax can be harvested in 75-85 days from the date of sowing. A moderately cool and humid climate is required by the crop, drought or heavy rains being injurious. Although flax removes little from the soil, long term rotations are advised chiefly with the idea that when the crop is sown the ground shall have been so well cultivated that weeds and diseases are completely controlled. The article contains full instructions for harvesting the crop and preparing the fibre.

181. DEPARTMENT OF AGRICULTURE, KENYA. 633.525.1
Ramie, rhea-fibre or China grass (*Boehmeria nivea*).
E. Afr. agric. J., 1936, 2 : 74-6.

The article discusses the probable cultural requirements of ramie under Kenya conditions. These are a certain humidity, a rainfall of 50 in. and the absence of a prolonged dry season, windbreaks every 300 yards, a rich soil and heavy manuring. Given these, replanting should only be necessary every 6 or 7 years. Propagation is preferably by division of the roots, but seed, layering and cuttings will succeed to a greater or less extent. The seed is sown under shelter in boxes. Cuttings are from ripe spring-grown stems cut into lengths containing 3 eyes; they are set in nursery beds, and must be shaded if the weather is hot. Straight, clean, unbranching stems are desired, hence close planting is advised such as 1 ft. apart in the rows; the distance between the rows may be anything from 1-3 ft., but on this latter point there is

no general agreement. The canes should average 4 ft. in length at maturity, i.e. when brown for one-third of their length. In preparing the fibre, retting and sun-drying are harmful; shade-drying gives a softer sample without loss of strength. The fibre is separated by hand or by a decorticating machine. The address is given of the maker of a small machine of this type which will turn out 275 lb. of fibre in 9 hours. The yield should be 1 ton of dry ribbons furnishing 50% of degummed fibre per acre. The dried ribbons seem to have a considerable market at about £20 per ton c.i.f. London. Manufacturers' reports stated that the Kenya product was much superior to China grass imported from elsewhere.

182. NUTMAN, F. J. 633.526.1

Agave fibres. I. Morphology, histology, length and fineness ; grading problems.

Emp. J. exp. Agric., 1937, 5 : 75-92.

The paper is in the nature of a progress report on the work done on agaves as fibre producing plants at Amani during the last few years. Agave fibres are of 3 fairly well defined types:—*Mechanical*, most strongly developed round the periphery of the leaf; these fibres are of great importance commercially; owing to their shape they seldom divide during manufacture and on their fineness depends the fineness of the sample. *Ribbon fibres* occur always in association with the conducting tissues though they are present in various sizes in all parts of the leaf except the extreme periphery; they form the longest fibres in the leaf and are important in that they split longitudinally, unlike the mechanical fibres, and therefore their original size does not influence fineness. *Xylem fibres* are of no commercial importance, being broken up and lost during decortication. Short leaves, whether caused by early cutting or environment, do not produce a markedly finer fibre than long leaves. Fineness of fibre is varietal, in which respect *A. amaniensis* and *A. cantala* are much superior to *A. sisalana*. *A. amaniensis* possesses a larger amount of short fibres than *A. sisalana*, but this is offset by the greater length of its leaves. The proportion of mechanical to ribbon fibre in *A. amaniensis* is twice as great as in *A. sisalana*. This fact is of technical importance, giving the fibres a different intrinsic make-up and probably affecting spinning behaviour. Methods of mechanical grading to replace the present grading by eye are thoroughly discussed and the defects of the present system pointed out. Nevertheless, expensive grading schemes cannot be put into operation until the consumer gives some indication of the type of fibre required, and so far this has not been forthcoming.

183. STOREY, H. H. 632.8 : 633.682

Virus diseases of East African plants. VI. A progress report on studies of disease of cassava.

E. Afr. agric. J., 1936, 2 : 34-9.

It has recently become apparent that the study of virus disease of cassava is complicated by the presence of several distinct viruses. At Amani, where the subject is being studied, two main viruses have been distinguished, the mosaic group and the brown streak group. The mosaic group in East Africa is divided into severe and mild strains and could be still further subdivided, if it were profitable. The severe and mild strains may not be those of a single virus, since experimental transmission by white fly (*Bemisia* sp.) has been obtained for the severe type only, and plants possessing a mild strain are not thereby rendered immune from the severe strain. Cassava varieties highly immune in West Africa have proved highly susceptible in East Africa at least to the severe group, which therefore is probably different to the West African strain. Brown streak virus has only recently been recognized as distinct from mosaic, but it is now known to be a transmissible systematic disease occurring in plants either free from or affected with mosaic. The insect vector of brown streak has not been found. The symptoms of all these diseases are described. Control might be effected by establishing healthy plots in remote districts particularly at high altitudes where the vector of mosaic at least is less active, but the only certain, though probably far from easy, method is the breeding of immune or tolerant varieties.

184. COOLHAAS, C. 633.71-1.83
 Kalidüngungsprobleme im Tabakkulturgebiet der Vorstenlanden. (**Potash fertilizer problem in the tobacco growing district of Vorstenlanden, Java.**)
Ernähr. Pfl., 1936, 32 : 87-91.

The author gives an account of experiments undertaken by the Proefstation voor Vorstenlandsche Tabak. The best tobacco soils are the young soils afforded by the volcanic ash from the volcano Merapi. These are rich in phosphoric and potash salts, but on the older brown red Merapi soils and on the calcareous black tuff soils, where farmyard manure was not used or was replaced by *Crotalaria* green manuring, the use of potash resulted nearly always in increased length of leaf and often improvement of quality and increased percentage of lighter-coloured leaves. It was found more difficult to influence burning quality by potash than to improve general growth and development. On the calcareous tuff soils sulphate of potash as well as acid fertilizers should be used with caution, since improved burning quality may be counteracted by increased chlorine absorption. Where a better quality in general without any specific improvement in burning quality is the aim, the sulphate may be used and even preferred to the nitrate. Where, however, improvement of the burning quality is wanted, potassium nitrate should be used on all grey ash soils in preference to sulphatic fertilizers. The response to potash on these soils will depend on the amount of volcanic mud they contain. [From author's summary.]

185. DEUSS, J. J. B. 633.72
 La culture du thé en Afrique. (**Tea planting in Africa.**)
Rev. Bot. appl., 1936, 16 : 910-2.

A concise summary of the tea planting situation in various regions of Africa. *Natal*. The climate is suitable but labour scarce, expensive, and not always very efficient since the interdiction of the further importation of coolie labour from India. There are 2 large and 4 small plantations of which the most important produces 675 tons. The total area of tea is about 800 hectares and the total yield 1,170,000 kg. *Nyasaland*. Tea growing here will never be a major industry, neither the climate nor the soil being entirely suitable. There are, however, about 5,000 hectares under tea, producing some 1,350,000 kg. The methods used are those of India and Ceylon, applied, the author states, without sufficient discrimination. He takes exception to the pruning methods, which he considers entail unnecessary work when the time comes to reshape the young trees 3 years after planting and, in the case of the annual routine pruning, leave the trees too high. *Mozambique*. This Portuguese colony has 200 hectares of tea, yielding 40,000 kg. *Uganda and Kenya*. These countries have not advanced in tea production so rapidly as the environmental conditions would seem to warrant. This is attributed to labour difficulties. The area planted is 4,800 hectares, yielding 1,350,000 kg. or 280 kg. per hectare which the author thinks is too little. *Tanganyika*. The area under tea is 440 hectares divided between 30 planters with only 3 factories between them, which explains, the author remarks, the poor quality of the tea produced. He adds that the tea is grown in hilly districts and that no precautions have been taken against erosion, the latter omission being an old English custom which has ruined so much of the best lands in their Eastern possessions. The author is not sure how often pruning is done but says it is probably annually, as there is a dry season and Indian methods are blindly followed. *Belgian Congo*. Tea is doing well in the Kivu district. No details are given.

186. OSIDA, M. 633.72-1.535
 Reproduction of the tea plant by means of cuttings in breeding work. [Japanese.]
Rep. agric. Exp. Sta. Nara. Pref. extraordinary, No. 4, pp. 54, abstracted in *Jap. J. Bot.*, 1936, 8 : (73) : 301.

The chief results of the author's work with cuttings are as follows:—Positive results were achieved, roots developing either through the callus or in the absence of callus. Best results were got by taking cuttings in early or mid-June, which may have been due to the abundance

of stored carbohydrates as well as to the humid conditions prevailing in June. The optimum temperature for root formation probably lies between 25°C. and 30°C. Sandy soil was generally preferred as being better aerated and having few parasitic organisms. It has the disadvantage, however, of drying out rapidly and is therefore not entirely suitable. Good results were obtained from the use of a clay soil, water capacity 39%, pH 3.65. A number of chemicals were tried for their stimulation of root growth but without conclusive results. [From abstract in *Jap. J. Bot.*]

187. BAUER, A. 633.72-1.8
 Das Nährstoffbedürfnis des Teestrauchs. (**Nutritional demands of the tea plant.**)
Ernähr. Pfl., 1936, 32 : 176-8, bibl. 17.

In this brief résumé the author brings out the following points :—The best soil reaction would appear to be slightly acid, the limits being about pH 4 and pH 6. Alkali soils can be improved by manuring with sulphur : certain diseases, moreover, such as Tea Yellow Disease, are due to lack of this element. Artificial fertilizers have been found useful. Heavy nitrogenous manuring alone is detrimental, being inclined to decrease the tannin content and make the plant more susceptible to disease. Opinions differ as to the efficacy of phosphates. Some hold that there is a direct relation between phosphoric acid content in the soil and quality. Others have observed that phosphatic manuring leads to premature ripening of the young shoots and increased starch content in the leaves. It is, moreover, considered that a high phosphate content of the soil increases susceptibility to *Helopeltis*. Potash would appear to be entirely beneficial in its effects. It increases resistance to *Helopeltis*, encourages growth and lengthens plucking time. It enables the plant to store reserves in the stem, so that it picks up quickly after hard pruning. It is particularly important in soils poor in bases, i.e. heavily weathered soils. Magnesium also plays an important part in such soils. It was suggested that manganese and ferric oxide enhance quality but this suggestion has not been confirmed by later work. Different workers have determined the ash content of tea and calculated the amount of nutrients removed by one plucking. Some of their figures are given here. Manurial schemes differ considerably in different lands, and normal treatments in Ceylon and in Assam are discussed here. Green manuring is now becoming more popular, shade and wind protection plants such as *Leucaena*, *Albizia*, *Erythrina*, bushy plants such as *Crotalaria* and *Tephrosia*, and creepers such as *Vigna Hosei*, *Indigofera*, etc., being used.

188. TUBBS, F. R. 633.72-1.542 : 581.192
 On the growth and carbohydrate supply of the tea plant, after pruning.
J. Pomol., 1937, 14 : 317-46, bibl. 22.

The author discusses clearly and in considerable detail experiments carried out in Ceylon. The following lines of investigation were undertaken :—The influence of type of pruning on the death of the bush or part of the bush at low elevations ; its influence upon the number of primary shoots produced after pruning both at high and at low elevations ; its influence upon the rate of growth of primary shoots at low elevations and the relationship between the leaf area on the bush and the rate of production of secondary shoots ; the growth of bushes after pruning at different elevations ; and lastly the reserves of the tea bush as influenced by type of pruning and climate. The three types of pruning were (1) "clean" pruning in which all branches were cut down to 18 in. from the ground and all thin stems and twigs were removed, the resulting bush being nearly leafless ; (2) "lung" pruning in which the above was varied by not pruning a number of branches until a few days before the "tipping" operation ; (3) "cut across" pruning in which the modification of "clean" pruning consisted in the removal of fewer branches below the pruning level. Three illustrations make the terms very clear. The three treatments were compared by field arrangements as "randomized blocks". At Perideniya (1,500 ft.) and Kiriella (200 ft.) the 6 blocks consisted of 3 plots each, each block including the 3 treatments,

their position within the block being randomized. At Talawakelle (4,600 ft.) the plots were randomized in 6 blocks of 9 plots each and comprised part of another experiment also. Each plot consisted of 250 bushes on about one-twelfth acre. In 1933 an additional experiment was carried out at Kiriella upon the relation between the number of leaves left on the pruned bush and recovery from pruning. The author summarizes as follows:—At 200 ft. die-back of frame branches and death of complete bushes occurs after pruning. This was reduced by those methods of pruning in which some leaves are left on the bush. A significant positional variance of die-back was found to be associated with variations in the number of leaves on the pruned bushes. Rapid growth prior to pruning increased the amount of die-back. The number of primary shoots produced after pruning was affected by the method of pruning at 4,600 ft., but not at 200 ft. above sea level. This is believed to be due to the occurrence of die-back at the lower elevation. The growth of these shoots is affected by the number of leaves left on the pruned bush but not by the length of time they remain. A significant interaction between these two factors was found. A correlation of $+0.99$ was found between the yield of new shoots and the total weight of leaves over a period of $14\frac{1}{2}$ months after pruning. The effects on yield of the three types of pruning were found to vary according to the elevation of the experiment and the time elapsed after pruning, significant treatment \times year and treatment \times elevation interactions being found. The resulting yields are accordingly considered separately for each year at each of the three centres. In general, they show that the presence of leaves upon the pruned bush increased the yield during the two years subsequent to pruning at 200 ft., but decreased it at 4,600 ft. At 1,500 feet no effects were discernible. Analytical data show that the method of pruning affected the carbohydrate level in the roots, in spite of the wide divergence in the amounts of new growth produced. The differences in reaction to pruning at different elevations are considered in relation to the discovery of a connexion between the amount of stored carbohydrate and the elevation at which the bush is grown. The linear regression $y = 11.17 + 0.20x$ (where y is the percentage of carbohydrate and x the elevation in feet above sea level) was found to account for 77% of the variance in carbohydrate content. Suggestions as to the reasons for the relationship are put forward and its ecological importance is discussed.

189. ITANO, A., AND TUZI, Y.

633.72 : 581.192

Investigation on the iodine content of tea.

Ber. Ohara Inst., 1936, 7 : 153-5, bibl. 2.

Leaves from some 10 brands of tea were supplied by the Tea Experiment Station, Kyoto, and were submitted to analysis for their iodine content by the authors. Hot water extracts from leaves of the same teas were also analysed. All contained iodine, the amounts varying from 0.45 to 1.20 γ per gram of dried leaves [$\gamma = \frac{1}{1000}$ mg.], the larger amounts being found in the younger leaves. From 33% to 75% of the original iodine present was extracted when the leaves were powdered and boiled with hot water for 30 minutes.

190. DEUSS, J. J. B.

633.72-1.55

La cueillette du théier. (**Tea plucking.**)

Rev. Bot. appl., 1936, 16 : 329-348.

La cueillette du théier et la production. (**Tea plucking in relation to yield.**)

Ibidem, pp. 510-19.

A detailed study of various systems of tea plucking. Tables are given showing the intervals at which tea should be plucked, based on rate of growth and quality of tea desired, rapid regeneration after plucking and economy. Instructions are given whereby the planter can determine the growth rates in any particular garden for himself and, this ascertained, the correct rate of plucking from the information provided in the article. The second paper urges the keeping of systematic records of yield and shows how this may be done in terms of dried tea from the green leaf, while taking into account certain factors, particularly the time of day or season of plucking, which influence the ratio of the weight of the wet to that of the dried tea.

191. GILLET, S. 633.73
Report on a visit to Southern India and Java. I. The coffee industry of Southern India. II. The coffee industry of Java.
E. Afr. agric. J., 1936, 2: 60-73, 149-63.

I. *Plantation coffee.* In S. India *arabica* coffee is grown at altitudes of 2,500-6,000 ft. with a rainfall of 50-170 ins. The sites are usually sheltered, steep slopes of semi-cleared jungle with a northerly or easterly aspect. Shade is retained because, although it reduces yield, it is a deterrent to leaf disease and borer. As a further deterrent to borer the trees are grown close together 6 ft. x 6 ft., and so produce a dense upper canopy, though losing most of their lower primaries and of course giving a lower yield. There is little pruning. Gormandiser (or sucker) growth is general, in fact 50% of one of the most renowned London marks is grown on gormandiser wood. In soil selection a rich jungle soil carrying a luxuriant vegetation is preferred. Shallowness is desirable so that the trees may have a reduced water supply during the dry months of January to March. This is supposed to increase yield. Coffee in S. India is almost entirely surface feeding, and to avoid root damage cultivation is reduced to a minimum. The author suggests that more use should be made of the envelope fork to incorporate the surface vegetable debris in the soil. The digging of 18 in. trenches in alternate rows and allowing them to fill up with fallen leaves, soil, etc., is a satisfactory method for S. India (but unsuitable for Kenya, where the author's coffee interests lie). These trenches check erosion and the organic matter they contain becomes filled with a mass of feeding roots from the coffee. Spraying with bordeaux against leaf disease is usual and effective. *Research work.* The research centre is the Mysore Coffee Experimental Farm at Balehonnur. Here it is emphasized that, though spraying with bordeaux will check 4 of the major pests and diseases, the time of application is of the utmost importance to success. Manurial trials in progress since 1926 have been almost barren of results, but data tend to show that sulphate of ammonia is the best of the nitrogenous manures and superphosphate of the phosphatic, while there is nothing to choose between sulphate and muriate of potash. Though experiment plot figures do not justify the application of fertilizers, the value of the latter is apparent when contrasting estates which do and do not use them. In estate practice a decline in yield may be expected after two years' discontinuance of fertilizing practices. Breeding work is concentrating on producing resistance to leaf disease combined with quality and much has already been achieved. Vegetative propagation is by cleft grafting, using waxed paraffin paper covers, from March to July (early S.W. monsoon) with 90% success, in other months with only 25% or less. Hardwood cuttings in the open have rooted to some extent, but subsequent growth has been poor. Green manurial trials are directed to finding a suitable cover for young coffee of sufficient height and density to reduce borer attack.

II. *Coffee in Java.* The policy of the Dutch in coffee growing has always been to combat pests and diseases by the introduction of resistant varieties rather than by remedial measures. Thus *arabica*, with which the industry started, suffered eventually from a series of ills and is now replaced by *robusta* after an intervening period in which certain *arabica-liberica* hybrids were used with some success. Elaborate and efficient, though in Java inexpensive, precautions are taken with new plantings to ensure the well-being of the plants and to prevent erosion. There is little systematic pruning, each tree being treated on its merits, although the single stem and a form of the multiple stem system are followed to some extent. There are two main coffee experiment stations and one large experimental farm which work in close co-operation with estate managers, one station having on private estates no less than 25 sub-stations in the maintenance of which the estate managers take a prominent part. In selection trial plots are established of both vegetative and seedling progeny from the chosen mother tree. The vegetative plots are composed of grafts made on stocks of the ordinary seedling material commonly used in the district since this will be used in estate practice and behaviour on selected rootstocks might not be comparable. Seedling plots are important since some parents breed true from seed and fail to thrive as grafts, while others suitable for grafting may split into a diversity of types from seed. The stations have now accumulated so much material that selection from estates is unnecessary. No selection is recommended for general planting until 10 years' records have been kept and the plant has been tested in various districts. A combination of hybridization

and selection is regarded as being more certain than selecting and propagating a mother tree purely on its apparent merits which may be impermanent ; thus crosses are made from trees having good qualities and the progeny are selected and can be studied from the start. In cross pollinating *robusta* the trees are no longer emasculated, but are covered over prior to flowering, and later the pollen, collected in quantity from the male parent, is dusted over the whole of the female parent. Any seedlings resulting from self-fertilization are easily recognized and discarded. The author thinks that with *arabica* its high self-fertility would render this method impracticable. Another method of obtaining seed from a selected cross in large quantities is to plant numbers of grafts of the two parents in isolated clearings. Since *robusta* is practically self-sterile, the resulting seeds will be natural crossings of the two. One-third of the new plantings in Java is of grafted material, but certain problems are still unsolved. Scion influence is believed to be much greater than stock influence ; nevertheless stock does exert an influence in that certain *robusta* stocks are better than others, and that as a general rule the more nearly related stock and scion are, the better the results. The method used is cleft grafting, in the case of old trees on suckers springing from the base or from the top of the main stem. In the former case vertical scion wood is used, in the latter lateral wood, and owing to the polarity shown by coffee the type of lateral wood used is all-important. Red paper graft covers have proved more effective than white. Uniform results are not always obtained with grafted material and the factors concerned in this still need investigation. Work on *arabica* improvement in Java is small but certain hybridization work is in progress particularly in crossing *C. congensis* and *C. arabica*. In selection of types for intermediate altitudes the best so far is Conuga, believed to be a cross between *C. congensis* and *C. robusta*. It must be vegetatively propagated to ensure purity. Other problems receiving attention are :—the effect of climatic conditions on incidence of flowering, i.e. the direct or indirect influence of the water content of the leaf, thus small-leaved forms holding less moisture may flower better in wet districts than large-leaved forms ; shade and cultivation methods, including root pruning ; indigenous weeds as cover crops compared with clean weeding, in which so far clean weeding has proved significantly superior to 12 different weed covers ; manurial trial results have so far been insignificant ; mealy bug control. In conclusion the author discusses the advisability of employing in Kenya, with possible modifications, certain methods of research and cultivation used abroad.

192. KENYA, SENIOR COFFEE OFFICER.

633.73

Coffee investigational work.*E. Afr. agric. J.*, 1936, 2 : 178-87.

This is a report on coffee research in Kenya for 1935. *Pruning*. Comparable rows of coffee trees were pruned annually at monthly intervals throughout the year. The effect on the trees of the time of pruning is discussed. In pruning single stem trees severe cutting back (an increasing practice) is deprecated. It debilitates the trees and induces biennial bearing. Directions are given for pruning multiple-stem trees on a system that has been found highly satisfactory at the Scott Laboratories and produced superior coffee to that of the single stem trees. *Spraying*. 1 or $\frac{1}{2}\%$ bordeaux, whether applied once or twice annually, gave 100% increase in yield over control plots. *Selection*. Two varieties from Abyssinia are under trial ; one, Harar, has in 6 years borne heavily each year and has pronounced drought resisting qualities. It had a favourable report on the London market, where its good quality was ascribed to good culture and preparation (apparently when marketed from Abyssinian sources it had proved inferior). Reports are given of other selections under trial. Reports on liquoring are given for coffees from various manurial plots but no conclusions can be drawn from them at present. *Mulching* is recommended, particularly in drought areas, provided the mulch is obtainable not more than 200 ft. from the headland ; beyond this distance it is probably uneconomic. *Shade*. A temporary shade plant fairly new to Kenya is the giant castor [botanical name not given—ED.]. *Planting out*. Large holes 4 ft. square by 2 ft. deep previously prepared and filled early with a mixture of soil and compost to avoid sinkage have given markedly superior growth compared with small holes whether the latter are manured or not. *Liquoring and fermentation experiments*. A summary of results is given. *Vegetative propagation*. Cuttings at first proved difficult to

root by any means, but the greatest success was obtained with naturally etiolated sucker shoots found in the centres of stumped trees and by the artificial etiolation and ring wiring of shoots from stumped trees. However, in 1935 the construction of improved frame propagators [not described—Ed.] and the use of forest loam as a rooting medium raised percentage success to 70%. Budding was a failure. Cleft grafting succeeded from the start. A list is given of the rootstocks under observation. *Hybridization*. A list is given of the crosses made during the year.

193. LIVERSAGE, V. 633.73 : 338.5

Kenya coffee. A graphic analysis of post war prices.

E. Afr. agric. J., 1936, 2 : 220-5.

The price movements of Kenya coffee are analysed and graphically recorded and compared with those of Costa Rica and Rio No. 7 coffees. It is shown that the value of coffee has in reality been much more steady than at first sight appears, and that in spite of increased production of Brazilian and mild coffees there is no evidence of any appreciable decline in the basic value of coffee in the world market. The seasonal cycle for Kenya coffee prices based on the years 1922-35, taking 100 as normal, shows a rise from 86 in July to 108 in December and 111 in January and February, falling to 108 in March, 100 in April and back to 86 in July. The reasons for this fluctuation are possibly seasonal variations in quality, the appearance on the market of coffee from different districts or even preconceptions on the part of the buyers. A further article on this subject is promised.

194. KILLICK, A. B., AND OTHERS. 633.73-1.543.1

Shade for coffee plantations.

E. Afr. agric. J., 1936, 2 : 44-7.

This memorandum concerns Uganda, Nyasaland and N. Rhodesia, the subject having been already discussed for Kenya and Tanganyika [*Ibidem*, 1935, 1 : 107-18 and 135-9 ; *H.A.*, 5 : 4 : 692, 693]. *Uganda*. From observations made on a number of experiments the following conclusions are drawn. Certain insect pests are definitely favoured by shade. *Robusta* is a shade loving plant, but will grow in the open provided the weeds are kept down and the ground mulched. Non-shaded conditions tend to produce overbearing. At 5,300 to 6,300 ft. shade appears to be unnecessary, but below this altitude it may be beneficial in reducing biennial fluctuation. In comparisons between overhead shade with periodical green manuring and no shade with clean weeding and various covers the shaded plot showed continuously a higher soil nitrate content, while the unshaded mulched plot had always the highest soil moisture content. Soil temperatures at 2 in. depth are more even under shade and may be as much as 10° lower than in the open. Experiments to determine the value of shade or particular unshaded ground treatments should be on a large enough scale to allow costings to be kept, since the benefit from any particular treatment may be obtained at an uneconomic cost. *Albizia stipulata*, though not indigenous, appears to be the most generally useful shade tree. The banana as a shade plant is in common use among the natives and it should be favourably considered. *Nyasaland*. Shelter belts, shade trees and surface mulches are considered necessary to combat the long dry season. *N. Rhodesia*. The need for shade is doubtful. Light shade is at least harmless, but certain trees inhibit the growth of coffee.

195. MORSTATT, H. 633.73-2.1 + 2.4 + 2.7

Kaffee-Schädlinge und -Krankheiten Afrikas. (Pests and diseases of coffee in Africa.)

Tropenpflanzer, 1936, 39 : 91-118, 273-99, and 455-81.

The author continues his articles on coffee pests and diseases, started *Ibidem* 38 : 413 ; *H.A.*, 1935, 5 : 4 : 696. In the first of his later articles he deals with pests and diseases that attack the stem, paying considerable attention to the various coffee scales. In the second the disasters of a pathological nature that occur to the leaf are described, while in the third attention is devoted to the pests and diseases which attack flowers and cherries.

196. KADEN, O. F. 633.74
 Richtlinien für die Veredlungs- und Resistenzzüchtung im Kakaobau.
 (Principles to be adopted in selecting and raising cacao trees.)
Tropenpflanzer, 1936, 39: 203-10, bibl. 7.

The present article is actually in continuation of a previous one by the same author in which he proposed and described a simple classification of the cacao tree into 4 species, the individual members of each of which may be further distinguished as yielding ordinary or "special" cacao [*Ibidem*, 1935, 38: 367; *H.A.*, 1935, 5: 4: 698]. Having made these differentiations, he here discusses some of the points which the planter should observe in selection. For the planter of "special" cacao the problem is comparatively simple, provided soil, climatic and other environmental factors are favourable. In choosing trees from which to raise new ones he must choose those whose fruits show a low tannin content in the seeds, thin, soft shells and the slender "special" cacao shape. In addition the fruits and the individual seeds should be heavy. Where all conditions are favourable yellow fruited varieties are preferable, but they are much less resistant to unfavourable environment and disease and, if planted under such conditions, should only form a small part of the plantation. Trees which actually produce cacao of the required grade, but which show morphological characters inconsistent with the production of this quality, should be avoided as parent trees. The planter of ordinary quality cacao should not try to raise the quality by planting seed of the "special" varieties, unless he has first proved the suitability of his conditions for growing such cacao. The most promising material for him would appear to be hybrids of the ordinary with the "special" type. Such hybrids already exist in most of the cacao lands and many have already proved excellent sources of cacao. In their careful selection and planting lies the best hope for the future.

197. PARODI, E. 633.74-2.4
 Sulle cause della decadenza della cultura del cacao all' Ecuador e possibili rimedi. (The causes of the decline in cacao production in Ecuador and possible remedies.)
Agricoltura colon., 1936, 30: 121-7, bibl. 7.

The two chief causes of the decline of cacao production in Ecuador have been *Marasmius pernicius* and *Monilia Roreri*, the first appearing in 1916 and the second in 1921. Their spread has, however, been due chiefly to the system of planting, which in fact has until lately merely consisted of getting as many plants as possible into a small area of cleared virgin forest and thereby insuring the maximum immediate return to the lessee of the land. The system was supported not only by the lessees but also by the owners, who were able to raise money on their estates on a basis of the numbers of plants grown. As a result of this planting was done far too close and every inducement was given to the spread of cryptogamic organisms. In 1925 the loss over extensive areas in Ecuador from *Marasmius* amounted to 90% of the crop, the fruits shortly after forming becoming atrophied, and later drying up and falling. Complete destruction by burning of infected stock was successful in at last checking the ravages of this disease and its incidence has lately become less important. *Monilia Roreri* has taken its place. The first symptoms of this disease, which only attacks the pods, are a faint discoloration of the young fruits. If the fruit is sectioned, dark grey mottling will be seen. In mature fruits dense white powdery masses appear on the outside, while inside the seeds will have largely disintegrated and putrefied. Losses due to this disease may amount to 70-85% of a crop or even sometimes 100%. The suggestion that bordeaux mixture should be used disregards the extremely dense planting system and the daily rainfall at the critical time. Eradication and burning of infected stocks and the initiation of reasonable planting systems can and are achieving much. At the same time a good deal of faith is pinned to a chance yellow-fruited hybrid between the Nacional variety and the Venezuelano, called Amarillo, which is now undergoing selection. New planting is being carried out at 4-5 metres apart and shade plants *Erythrina micropteryx*, *E. umbrosa* or *Pithecolobium Saman* are being set at 16-18 metres apart rather than 8-10 metres.

198. GRAHAM, G. R. 633.74-2.4
Black pods on cocoa trees.
J. Jamaica agric. Soc., 1936, 40 : 607.

The fungus disease of cacao known as pod-rot, in which the pods blacken and fall, can be checked, it is stated, if certain measures are taken. Clean away all trash, dead leaves and loose mould from round the tree to a width of 4 ft. Remove and burn all affected pods. Spray the tree thoroughly with bordeaux mixture 4 : 4 : 40, the lime and bluestone being each mixed separately in 20 parts of water, and poured simultaneously into a third vessel. The spraying should be repeated a second year just after the young pods have started to form.

199. KALSHOVEN, L. G. E. 633.832-2.76
 Boorders in kruidnagelboomen. (**Borers in clove trees.**) [Dutch, English summary.]
Landbouwe., 1936, 12 : 165-90, bibl. 17.

Identifications, descriptions and, where possible, the life histories are given of a number of wood-boring beetles which attack cloves in the East Indies, special attention being paid to the species found in the Dutch possessions.

200. FRANCOIS, E. 633.832
 Giroflier et girofle. (**Clove trees and cloves.**)
Rev. Bot. appl., 1936, 16 : 589-608, 802-907.

This article gives an account of the clove industry of the world in all its aspects, cultural, commercial and chemical, from the earliest to the present time. In the course of the paper the author remarks that the clove has never given rise to any mutations which can be fixed, and that any deviations from the normal that have occurred, such as size of bud, heaviness of yield, intensity of aroma or low branching, as well as less desirable changes, have always been due to environment. The question of biennial bearing is mentioned but, although alternate heavy and light yields are usual, there are frequent exceptions. Trees have been known to yield heavily 4 years in succession. Certain trees in Madagascar which appear to have broken away from the alternate bearing rhythm in favour of regular bearing, are being vegetatively propagated, or rather the attempt is being made, for the clove is notoriously difficult in this respect.

201. DRIEBERG, J. C. 633.833
Cinnamon. A historical sketch of the industry in Ceylon.
Trop. Agriculturist, 1936, 87 : 237-44, and Editorial note, pp. 195-6.

The long commercial history of the cinnamon industry is one of a slow but persistent decline in prices. State assisted plantations are, moreover, about to be established in South America, to which region over 40% of Ceylon's output is now exported. The continuous fall in prices, it is remarked in the Editorial note, is most remarkable in that Ceylon's monopoly of cultivated cinnamon was never previously challenged and the fall synchronized with a considerable reduction in the acreage under cultivation. The low price may possibly be correlated with the increasing use made of the rival commodity cassia (*Cinnamomum Cassia* Bl.). Figures of exports to various countries are given and discussed. Possible causes of deterioration of quality and market depreciation are :—(1) Admixture of bark from spurious types growing with the cultivated cinnamon. It is noted that bark from the middle of the bush or the middle of a branch is superior to that from the outer shoots on the upper or lower parts of the branch. (2) Soil conditions. Cinnamon bark of the finest quality is obtained only on white sandy lands. On stiffer soil the quality both physically and chemically is reduced. (3) Careless handling of the trees during declining prices in an attempt to get quantity regardless of quality. (4) Inefficient cultivation. (5) The exportation of chips which, being much cheaper, are bought in preference to quills.

202. AGRICULTURAL DEPARTMENTS AND AMANI RESEARCH STATION, EAST AFRICA. 633.85

Prospects for the production of tung oil in East Africa.

E. Afr. agric. J., 1936, 2 : 101-10.

Memoranda on the progress of tung tree cultivation from E. African territories. In general under E. African conditions *Aleurites montana* was comparatively easy to grow while *A. Fordii* was not. *Montana* oil is now accepted on the market at 95% of *Fordii* prices. *Kenya*. *Aleurites Fordii* does not seem generally suited to the country. The standard of cultivation has hitherto been low, and experimental plots receiving more intensive and careful culture are to be established. The marked variation in growth shown in plantations may be due to genetic causes. Grafting and rootstock experiments are in progress. The very few plantations of *A. montana* in Kenya (mostly at about 5,700 ft.) are growing strongly. *Uganda*. Neither *A. Fordii* nor *A. montana* have done well from seed. *Tanganyika*. The only successful plantation is one in which the trees were planted in specially prepared pits, 3 × 4 ft., filled with rich compost. Trees put out without special preparation have made little progress. At Amani germination of *montana* seed from China was poor, but those that grew have done well. *Nyasaland*. *A. montana* in trials is growing well and attempts are being made to develop its cultivation as a village industry. *A. Fordii* has been less successful. *N. Rhodesia*. *A. Fordii* is a comparative failure, dying back to the ground every dry season and doing little better on irrigated ground. *A. montana* grows well and has reached a height of 7 ft. in 4 years from seed.

203. PYNAERT, L. 633.85
Les *Aleurites* producteurs d'huile de bois ou de tung. (*Species of Aleurites*
yielding wood- or tung-oil.)

Bull. agric. Congo belge, 1936, 27 : 70-102, bibl. 19.

This article consists of a review of the methods of tung tree cultivation and the conditions essential for success as found in the various countries growing this crop. The object of the survey is to discover whether the tree could be profitably grown in the Belgian Congo and the answer, the author considers, is in the affirmative.

204. MINISTER FOR AGRICULTURE, NEW SOUTH WALES. 633.85
Minister's statement on tung oil production.
Agric. Gaz. N.S.W., 1936, 47 : 671.

A statement issued by the Minister for Agriculture advises the utmost caution before the commercial planting of tung oil trees is undertaken on any large scale. Under N.S.W. conditions the total annual cost of production per acre would be £6 10s. The return per acre would be about 400 lb. of oil, now worth 9½d. per lb. or £90 per ton in Sydney ; 2,400 lb. of fruit is required to produce 400 lb. of oil. This represents 36,000 whole fruits and gives some indication of the work involved in picking up the fruit from the ground. On this basis 2,400 lb. of fruit with oil at £90 a ton would return £8 16s. 10d. per acre, leaving a surplus to growers of £2 6s. 10d. per acre.

205. FREISE, F. W. 633.88
Brasilianische Medizinalpflanzen. (*Medicinal plants of Brazil*).
Tropenpflanzer, 1936, 39 : 241-53 and 380-9.

In these articles the author deals with the medicinal plants according to the part of the plant from which the medicinal element is derived. In the first article he gives notes on plants which possess valuable medicinal properties in their roots, bark or wood. In the second, plants containing them in their leaves are considered. In the third, notes are made on plants whose flowers contain the valuable constituent and on plants which are used in their entirety for extraction.

206. CHEVALIER, A. 633.912
 Les premiers découvreurs des espèces du genre *Hevea* et les plus anciens spécimens d'*Hevea*'s conservés dans les herbiers du Muséum de Paris. (**The first discoverers of *Hevea* species and the earliest specimens of *Hevea* still preserved in the herbaria of the Muséum de Paris.**)
Rev. Bot. appl., 1936, 16 : 616-24, bibl. in text.

The first explorer to have observed and recorded a latex producing plant of the present genus *Hevea* was Fresneau about the year 1748, and from evidence here discussed it appears certain that this tree was *H. brasiliensis*, the present *Hevea* of commerce, and not *H. guyanensis*. This in spite of the fact that *H. brasiliensis* has never since been recorded from French Guiana where Fresneau's specimen was found, with the possible exception of an unnamed specimen collected by Sagot in 1855 and now in the Muséum de Paris. No specimen of Fresneau's plant exists. The author discusses the confusion of names and synonyms which envelops the material sent home from time to time by various collectors and botanists and concludes that by the first quarter of the nineteenth century the Muséum de Paris contained 4 species :—(1) *H. guyanensis* discovered by Aublet in 1762, (2) *H. brasiliensis* first seen by Fresneau in French Guiana in 1748 and first collected in Para by Puget d'Orval in 1785, (3) *H. Spruceana* Muell. Arg. collected in Brazil and taken to Lisbon during the French occupation, and (4) *H. Kunthiana* Baillon, a mysterious species collected by Bonpland and Humboldt in 1801 in the Upper Orinoco basin and never seen since. Possibly it is identical with *H. pauciflora* Muell. Arg. which it closely resembles. There is now a number of known *Hevea* species, but of the 12 studied by Ducke* *H. brasiliensis* is the only one giving a high grade rubber ; nevertheless, the possibility of the others as rootstocks should be investigated and the author cannot understand why the commercial rubber growing countries have not long ago collected and grown every variety of *Hevea* for hybridization and other studies. He suggests that the South American forests should be explored for further species which he is sure exist and he recommends an international research programme in which Great Britain, Holland, France and Brazil should combine.

207. AHMED, M. S. 634.41
The anonas† in Egypt.
Bookl. Minist. Agric. Egypt. hort. Sect., 14, 1936, pp. 35, bibl. in text.

The history of the introduction of anonaceous plants into Egypt is outlined and the botany of the family is discussed. A table comparing the food values of the principal anonas with those of mango, kaki, fig and grape shows that the anonas are richer than any in protein, fat and sugar and that the calory value of *A. Cherimolia*‡ (the only one recorded) is 822 per kg. compared with mango, the next highest, with 741. The reputed medicinal properties are briefly mentioned. In spite of the fact that *Anona Cherimolia* is recommended by most writers for cultivation in subtropical regions in Egypt, *A. squamosa* has proved the most successful under the comparatively dry conditions in the interior, thriving (given adequate watering) even on the edge of the desert where the relative humidity is low and extremes of temperature prevail. *A. Cherimolia* is only really successful on a narrow strip of the Mediterranean coast where frost is unknown and the relative humidity is constant throughout the year at 70-75%. The ideal soil is a rich well drained loam. Thriving plantations have (with proper management) been established on fine sandy reclaimed desert soils. Propagation is by seed, grafting and budding. Seeds retain their viability for 3 or 4 years. Seeds sown the same year as harvested gave a 45% germination, but, if exposed to the cool night air for a week, the percentage rose to 90%. Year-old seed gives a high percentage without treatment. Germination, which ordinarily takes 40 days, may be hastened by either sand-papering the seed coat, soaking the seed in water for 3 days or sowing in beds with a high moisture retention. The addition of nitrogenous manure to the seed beds of plants being raised for rootstocks increases the success of future budding or grafting operations.

* Ducke, A Revision of the genus *Hevea* Aubl. *Archivos do Instituto de Biologia vegetal*, 1935, 2 : 2 : 217-46.

† Kew hand list, 1931, *Annona* spp.

‡ Kew hand list, 1931, *Annona Cherimolia*.

Seedlings are transplanted in March when a year old and worked the same summer, but a year may be saved by sowing under glass in January and planting out in April. Treated thus they can be budded or grafted in July of the same year. As rootstocks *A. squamosa* is a common and successful stock for *A. Cherimolia*, while *A. senegalensis*, which grows vigorously in Egypt, is now under trial and gives every sign of being very useful. Whip grafting is the form of grafting used, the scions being from 1-year-old branches at the end of the resting period, by which time they are of a suitable size to match well-grown year-old seedling stocks. Shield budding is preferable to grafting whenever the bark is in suitable condition to work easily. The seasons for working are March to April and August to September. In the two latter months the spring failures are reworked. Final planting out takes place when 2 years old. If bare root transport is necessary, the plants should be cut back and the stem and branches painted with melted paraffin wax of low melting point. The root systems are not waxed but are first soaked in water and then wrapped in wet paper and straw and packed in bundles of 10 or more. Planting is at 3-5 metres apart; a crowded plantation engenders a high humidity and assists fruit setting. Irrigation depends on soil but it is certain that very frequent watering in sandy soil encourages flowering and fruit setting and reduces the danger of fruit shedding. Advice on manuring is given, but no experimental work has been done. The flowers are self-fertile but protogynous. In hand pollination the stigmas are most receptive as the flower is opening. Fruiting starts at 4-5 years old, a tree of the latter age yielding about 120 fruits with a maximum of 500 when fully grown. There are, however, as yet, no yield records.

208. AHMED, M. S.

634.41 : 581.162.3

Pollination and selection in *Anona squamosa* and *Anona Cherimolia*.*

Bull. Minist. Agric. Egypt, tech. sci. Serv., hort. Sect., 157, 1936, pp. 29, bibl. 11.

The *Anona squamosa* flower is perfect, protogynous and entomophilous. In the drier parts of Egypt where, moreover, insect visitors may be scarce, the stigma loses its receptivity very soon, so much so that artificial pollination has often to be resorted to. In the more humid districts of Alexandria the trees bear heavily without such attentions. In artificial pollination the pollen can be collected, without reducing the yield, from flowers on the young wood at the exposed extremities of the branches. These flowers would probably fall in any case. The best fruits are usually formed on the older wood and in the lower parts of the tree and therefore these flowers should be preserved for fertilization. To prepare the pollen the flowers are gathered and placed overnight in a dry container such as a paper bag. In the morning the perianth is removed and the sticky pollen and anthers are transferred to a glass vessel. The pollen should be a creamy colour and not brown or black. The stage at which the female flower is ready for pollination is when the perianth is fully developed but with the distal ends still attached about half way down. Early morning from 5-8 a.m. or late afternoon from 5-7 p.m. are the best times for the operation. A man and a boy should pollinate 60-70 6-year-old trees daily. As the succession of bloom is a long one, each tree should be gone over a total of 7-10 times, at 4-day intervals. *Anona Cherimolia* can be treated in the same way. The result, however, will be less pronounced, partly because it is not really suited by the Egyptian climate except on the coast and partly, it was thought, because the stigma dries up even more quickly than in the case of *A. squamosa*. However, moistening the stigmas with a drop of water immediately before transferring the pollen did not improve the set. *A. squamosa* and *A. Cherimolia* are both self-fertile. The cross *A. squamosa* × *A. Cherimolia* was successful, but the reverse cross was not, and it is now being repeated on a larger scale. At present with *A. squamosa* horticultural varieties are not recognized. Attempts at selection brought out the following points. The number of seeds per fruit varies greatly on the same tree, and bears no relation to the size of the fruit or to the number of developed carpels. Selection for size was impossible because in Egypt early fruit setting always gives large fruits and later setting small ones and, further, fruit size is greatly influenced by atmospheric and soil conditions. The flavour is also at its best with early

* Kew hand list, 1931, *Annona squamosa* and *Annona Cherimolia*.

set fruits, later set fruits which may have to be ripened off the tree being distinctly inferior. The fruit shape is a constant character of a given tree but of no market value. Colour is determined by maturity at harvest, method of artificial ripening if used, and the time of picking. The proper stage for picking to ensure satisfactory keeping up to 3 days without loss of appearance is when the lines between the "areolae" become creamy white. The author looks to good cultivation and early pollination to produce first-class fruits in *A. squamosa* rather than to selection by vegetative propagation. *A. Cherimolia* on the contrary varies considerably from seed particularly as regards flavour, some seedlings being definitely unpleasant. Here selection can be of use and in Egypt six varieties from local trees have been propagated.

209. UPHOF, J. C. T. 634.441
 Der mango in Florida. (**The mango in Florida.**)
Tropenpflanzer, 1936, **39**: 501-12, bibl. 46.

This article is chiefly useful to the non-German reader for the good, selective bibliography at the end.

210. GALANG, F. G., AND AGATI, J. A. 634.441-2.111
A progress report on the influence of heat and smoke on the development of
Carabao mango buds (*Mangifera indica* L).
Philipp. J. Agric., 1936, **7**: 245-59, bibl. 10.

Mango smudging or the smoking of the trees to induce early flowering has almost become a recognized part of mango cultivation in the Philippines. The method is laborious and expensive and studies are now in progress to discover any economical modifications which may be practical. In this paper the influence of heat, carbon monoxide and carbon dioxide on the development of the mango bud was studied. The material used was grafted plants grown in galvanized drums 42-49 cm. in diameter and 30·5-38·5 cm. in depth. The plants had already flowered the previous year. They were placed in three enclosed chambers and the different groups treated respectively with precooled smoke, heat alone and heat and smoke in combination. The combination of heat and smoke, as in ordinary smudging when the fires are built in or under the trees, produced bud development in 8 days on 5-month-old twigs and in 29 days on younger twigs. With precooled smoke alone the first response on any twig did not occur for 31 days. A medium temperature, 30°C., combined with a dense cloud of smoke produced a higher forcing effect on dormant mango buds and a fairly simultaneous opening irrespective of age of bud. Smoke combined with a lower temperature took longer to cause opening. The older buds always opened earlier than the younger ones. Medium and high temperatures with dense smoke resulted invariably in vegetative growth whereas in lower temperatures and with precooled smoke flower buds were formed as well as leaf buds. No dormant bud opened on the unstimulated controls.

211. OTANES, F. Q. 632.752 : 634.441
Some observations on two scale insects injurious to mango flowers and fruits.
Philipp. J. Agric., 1936, **7**: 129-39, bibl. 21.

Two scale insects, *Puto spinosus* Robinson and *Coccus mangiferae* Green, which have been found to be abundant on and harmful to the young growths, flowers and fruits of mango in the Philippines, are described. Control measures suggested are spraying with soap and water at a concentration of 40 grams of powdered soap per gallon of water. This spray may be either pre- or post-blossom, but it is injurious to flowers in bloom. The same concentration should be used on the nests of the tree ants which farm these insects. It has been found that the control of the ants materially reduces the spread of the scales. The ants transport the insects from tree to tree along the ground, and to prevent this the trees may be banded. The ants may also be controlled by baits of poisoned syrup which will attract the young and laying queens. The ants, however, are to a certain extent beneficial in destroying other insect pests of mango and their exact status in the economy of the mango in the Philippines has yet to be established.

212. LAMBOURNE, J. 634.571-1.541

The rambutan and its propagation.

Malay. agric. J., 1937, 25 : 11-17, bibl. 8.

The rambutan (*Nephelium lappaceum* L.) can be propagated vegetatively by marcottage, the etiolation method, budding and grafting. Budding and grafting require the provision of root-stocks which may be seedlings or, if standardized stocks are required, raised vegetatively by the etiolation method or by marcotting. The different methods are described. Marcottage or gootee layering is well known to all horticulturists. Etiolation is a form of layering in which the plant to be propagated (originally probably a marcot) is planted at an angle of 30 degrees and, when established, the branches are pegged down in shallow trenches until the shoots appear. The shoots are earthed up gradually as they grow until covered to a depth of 6 in. When they are a foot high and becoming slightly woody they are ring wired just above the junction with the main branch, the earth being temporarily removed for the purpose. Roots should appear within 4 months, when the rooted shoots should be removed and potted or bedded in the shade until thoroughly established. In budding the modified Forkert method is advised. This is a patch bud in which sufficient bark of the stock is removed by tearing it down in one or more strips from a transverse incision : two-thirds of this flap is cut off and the base of the bud-patch is inserted beneath the remains of the flap and tied. An experienced budder should obtain 70-90% takes. Grafting is not described. The rambutan resents transplanting and seedling stocks or budded plants should be prepared for this some weeks in advance by cutting through the tap root with a long knife passed under the plant in the case of seedlings, and with budded plants by cutting through the soil and outgrowing roots three-quarters of the way round the plant and at a distance of 5 in. from the stem, so as to leave the plant with an undisturbed ball of soil within the limits of which new fibrous roots will form. Losses of transported plants are reduced, if the plants are previously established in 10-in. earthenware pots.

213. MARSH, T. D. 634.575

Sapucaia nut, *Lecythis* sp.

Malay. agric. J., 1937, 25 : 18-22, bibl. 1.

The sapucaia, a forest tree of tropical S. America, is of the same natural order as the Brazil nut but produces nuts of far finer flavour which command a better price. At present it is purely a wild product but attempts have been made to acclimatize certain species at Serdang Experiment Station, Malaya. These were *Lecythis Zabucayo* Aubl., *L. Pisonis* Camb. and *L. Ollaria* L., all of which produce edible nuts, though the one chiefly known in commerce is *L. usitata* Miers. Of the three the only one to grow with any vigour at Serdang was *L. Ollaria*, which fruits 8½ years from planting. Propagation is at present by seed sown in moist river sand in full sun. Marcotting produced callusing but no roots ; the etiolation method is under trial, but it is too early for results. Some small success has been obtained with cuttings in open beds. The chief cultural requirement appears to be a well-drained soil.

214. GALANG, F. G., AND OTHERS. 634.573 : 581.143

Fruiting as related to vegetative growth in cashew, *Anacardium occidentale* L.

Philipp. J. Agric., 1936, 7 : 21-33, bibl. 7.

The growth processes of cashew trees of varying ages from 10-30 years were studied. A series of measurements of vegetative and fruiting growths is tabulated and statistically compared. It was found that the bearing twigs and flower flushes, either terminal or lateral, in the different cardinal directions were longer, more stocky and had a greater total leaf area than the corresponding non-bearing parts. The study was made to discover the most efficient methods of increasing the yield of the cashew. The cashew appears to bear regularly under normal conditions and the problem of biennial bearing does not, so far, occur.

215. PAUL, W. R. C.

634.573

The cashew nut industry of South India.*Trop. Agriculturist*, 1936, **87** : 166-73.

The cashew (*Anacardium occidentale* L.) was introduced into Southern India by the Portuguese and now grows wild over a wide area. It has for long been subjected to a somewhat haphazard cultivation but latterly more attention has been paid to it, with the result that in 10 years the export of kernels from India has risen from 300,000 lb. to 9,000,000 lb. Varietal differences exist in colour, and shape of fruit, size and shape of nut and kernel, season of bearing and tendency to shed flowers. Local research stations have now become interested in selection work. Price is determined by the quality of the kernels which should be white, bold and hard. The percentage of kernels from nuts also affects the price, 28% being obtained from South Kanara (India) and 30% from East African grown nuts. Large nuts do not necessarily produce large kernels. Planting distances are from 20-40 ft. ; if the former, the trees should be reduced in number later. The cashew transplants badly with bare roots so that it is usually sown in its permanent position, or either raised in baskets or transplanted into them when 10 days old and later planted without removal from them. There is a good response to manurial treatment which, however, is seldom, if ever, practised. In India the nuts are often harvested prematurely in order to obtain an early cash return, but this results in damage to the immature fruits and flowers. It would be preferable to allow the nuts to drop and to collect them off the ground as in East Africa. Bearing may begin in 18 months from seed, economic yields in the fifth or sixth year and full bearing by the tenth year. For overseas markets the preparation consists in shelling, peeling, grading, and packing in hermetically sealed cases. The article concludes with a survey of the possibility of extending the industry to Ceylon where at present the trade is only local. It is pointed out that the cashew is essentially a waste land crop and might well solve the problem of providing a profitable perennial crop which will thrive in the dry districts without irrigation. An editorial note doubts whether the gross income of cultivated plantations could exceed Rs. 45 per acre in Ceylon, which would be insufficient. This question is being examined by the Department of Agriculture by means of a number of trial plantations throughout the country.

216. CHEVALIER, A.

634.58

Monographie de l'arachide. II. L'arachide au Sénégal. (Monograph on the groundnut. II. The groundnut in Senegal.)*Rev. Bot. appl.*, 1936, **16** : 673-872, bibl. 758.

Part I entitled "The groundnut in general" appeared in several papers in 1933 and '34 in vols. 13 and 14 of this journal. The subjects then treated were :—Classification botanic and agronomic, history, systematics, biology and physiology, chemistry, pests and diseases, edaphic and climatic conditions, distribution and the production of different countries. Part II concentrates on the groundnut in Senegal, and deals with research work and the incentives to cultivation in West Africa, the principal factors on which yield depends, technique and improvements in cultivation. It contains a discussion of some recent work in Formosa on the biology of the flowers and fruit and notes on the unsuitability of certain West African soils, on soil bacteria, virus disease, and in conclusion a chapter on the possibilities of developing the cultivation of oil bearing plants in the French colonies. There can be little known about the groundnut which has not received attention in this monograph.

217. SHIBUYA, T.

634.58 : 581.145.1/2

Morphological and physiological studies on the fructification of peanuts (*Arachis hypogaea*).*Mem. Fac. Sci. Agric. Taihoku*, **17**, 1936, pp. 1-12. Abstracted in *Jap. J. Bot.*, 1936, **8** : (78), 317.

The author's investigations show that the gynophore of *Arachis hypogaea*, the peanut, may grow in darkness and that white light is harmful to the process. No fruits are borne under dry conditions, direct contact with water being essential. Oxygen is also necessary, a fact which

explains why sandy soil is particularly suitable. The part of the gynophore above ground varies in length according to conditions, the maximum observed by the authors being about 16 cm. Maximum growth is found at the tip just behind the ovary borne on it. Growth starts in the ovules on the fifth or sixth day after penetration of the soil, beginning in the basal ones. The average number of flowers produced on the "runner" type (creeping stand) is 4·68 per day covering a period of 169 days, in the "bunch" type (upright stand) 14·24 per day covering 74 days. Only a few of these penetrate the soil, generally those on the lower branches and nodes. Flowers not producing gynophores amount to about 30%. The fact that sterile flowers in peanut are not staminate but hermaphrodite is again noted by the author. [From abstract in *Jap. J. Bot.*]

218. BAUER, A. 634.6
Die Ölpalme. Eine Wirtschafts- und Agrarstudie. (The oil palm. Trade and cultivation.)
Ernähr. Pfl., 1936, 32 : 278-86, bibl. 20.

The most noticeable feature of palm oil production is its extremely rapid rise in the last ten years. As an example of this, in Sumatra in 1924 production was 5,000 tons, whereas in 1935 it rose to 143,000 tons. In 1934 world production of vegetable oils amounted to 7·3 million tons, of which 550,000 tons were palm oil as compared with olive oil 800,000 tons and coconut oil 800,000 tons. The normal oil yield of an acre of palms greatly exceeds that of such crops as soya bean, groundnut or coconut. The many uses and advantages of palm oil suggest that further extension is still likely and desirable. The crop needs a deep loam rich in humus and neutral in reaction for optimum growth. Selection has already increased oil yields and has reduced the percentage of sterile palms. Figures show that the palm may be expected to yield 900 lb. per acre in the fourth year and to increase its yield up to the eleventh year. The large amount of nutrients removed from the soil yearly must be made good and the author suggests that each year the following amounts of fertilizer elements should be added :—60-80 kg. N, 50-60 kg. P_2O_5 and 120-150 kg. K_2O per hectare [or 53·4-71·2 lb. N, 44·5-52·4 lb. P_2O_5 and 106·8-133·5 lb. K_2O per acre of 61 trees.—Ed.].

219. THOMAS, A. S. 634.6
The oil palm in Uganda.
E. Afr. agric. J., 1936, 2 : 5-11, bibl. 2.

Elaeis guineensis has only been recorded wild from one locality in Uganda, the fruits being of a poor type, and the author doubts whether it is really indigenous to the country. Seed has been imported at various times and in 1927 the plot of 300 oil palms at Entebbe, planted by the Forestry Department in 1921, were handed over to the Agricultural Department, since when these trees have been individually recorded. There are now five distinct and mostly poor strains in cultivation in various parts of Uganda. Selection work at present has been done only on the Forestry Department's plot, now thinned to about 105 trees. On these fruit ripens throughout the year with a peak production from July to September. There is considerable variation among these palms in yield (that of some being fairly heavy) and in fruit character. Most of the fruit is below the standard required by other countries engaged in palm breeding, especially as regards the percentage of pericarp. Seedlings from the best trees have been planted in various districts as well as plants from imported seed. It is considered that, while Uganda will never be an exporting country of palm oil or kernels, the cultivation of the palm might be of great value in the local economy.

220. DWYER, R. E. P. 634.61
A survey of the coco-nut industry in the Mandated Territory of New Guinea.
New Guinea agric. Gaz., 1936, 2 : 2 : 1-72, bibl. 38.

The most important agricultural product of New Guinea is copra, the export from a planted area of 225,000 acres being equivalent to 40% of the total exports of the South Pacific Ocean. Most of the plantations are in the hands of European companies, but the fundamental importance to

the internal economy of the Territory of the plantation of large areas by the natives is recognized. The history of the development of the copra industry is traced from the beginning of German colonization to the present time, the present economic position is surveyed and the factors influencing the fluctuating prices are discussed. In spite of the present low value of copra the chances of recovery are reassuring, though any long term assessment of the prospects should be approached with caution. An extension of planting is advocated in view of the fact that the uncertainty for the future of copra is no greater than for that of other oil-producing crops and that the New Guinea product is steadily improving in quality as improved methods of curing are employed, a substantial premium being already obtainable over copra from certain other sources. The condition of New Guinea copra on arrival in England and manufacturers' requirements and prejudices are discussed. An account of the various reliefs afforded to the copra industry in the Territory by various enactments of the Australian Government and New Guinea Administration is given. The above are only a few points taken from a very comprehensive survey and much of the information provided will prove of interest and value far beyond the confines of New Guinea.

221. KADEN, O. F. 634.61-2.76
 Die Nashornkäferplage der kokospalmen im Golf von Guinea. (**The *Oryctes* beetle pest of coconut palms in the Gulf of Guinea.**)
Tropenpflanzer, 1936, **39**: 410-5, bibl. 3.

The species responsible for the very serious losses in coconut palms in the Gulf of Guinea are *O. monoceros*, *O. boas*, *O. gigas* and *O. latecavatus*. A brief account of their life histories is given. Previous remedies consisting of the collection and removal of infested parts and insects and spraying with a 4% carbolineum have proved unsuccessful. After a consideration of the incidence of similar infestations both there and elsewhere the author suggests that attention to the following points may be of assistance. Use of sites where the soil is permeable and there is no stagnant water. Use of palms chosen by selection which, owing to the morphological character of their top growth, present the greatest resistance to the beetle. Lastly it is essential that measures should be taken to protect bird life by the planting of trees where they can nest and have a certain degree of sanctuary such as *Pentaclethra macrophylla* and *Pachylobus edulis*, and by stern restriction of bird removal or destruction. In support of this the author cites the case of S. Tome, where bird life has become negligible thanks to the removal of such cover and the *Oryctes* beetles swarm, and that of Principe, a "birds' paradise", where the woodpecker and certain weaver birds abound and where the "life work of *Halcyon malimbicus dryas* and *Ploceus princeps* is guarding the palms from these insects." This they do most effectively.

222. LESTER-SMITH, W. C. 634.61-2.76 : 632.96
Traps for the black beetle pest of coconut palms.
Trop. Agriculturist, 1936, **87**: 299-302.

A method is described of destroying the coconut black beetle by inoculating specially prepared refuse pits with cultures of the entomophilous fungus known as green muscadine. The beetle enters the refuse pits to breed and the grubs (and often the adults) are attacked by the fungus and destroyed. Enough muscadine is supplied by the Ceylon Department of Agriculture to inoculate one pit and other pits are then infected after 3 months with material from the first one, each pit being able to supply 5 more. The construction of the pit traps is described in detail.

223. UPHOF, J. C. T. 634.62
 La dattier dans le SW. des États-Unis. (**The date palm in South-West U.S.A.**)
Rev. Bot. appl., 1936, **16**: 89-96, bibl. 51.

The date palm in U.S.A. is grown with commercial success in central California, Colorado, Arizona and parts of Texas. It will withstand a temperature of $-12^{\circ}\text{C}.$, and a soil salinity up

to 3%, these being the extremes. Propagation is by offshoots which are detached by the aid of special instruments, dried off for about 10 days and then planted at a depth of not more than 20 cm. in propagating frames constructed of lathwork, in which a moist and warm atmosphere is maintained. When the offshoots have formed from 5 to 7 leaves they are planted out, usually in April or May. The spacing is from 9 m. to 9.5 m. according to variety. The first year in the field the young plants are protected from cold by coverings of sacking or paper. Pruning consists in removing the two lower rows of leaves at the end of the fourth year. Later, when the palms bear, the leaves immediately above the fruiting racemes are removed. Date palms which begin to bear when too young are regarded with suspicion. At 4 years old, 2 bunches may be borne, and at 6 years 4 or more. Irrigation is practised, but water is withheld during the flowering period and is given again after this is over. To effect pollination 2 male plants are allowed for every 50 female. Not all male plants produce fertile pollen regularly. Some male trees, at least, are fertile one year and sterile the next, and a great many never produce viable pollen. There appears to be a tendency to biennial bearing. Artificial pollination is often resorted to. The pollen may be stored and will remain viable for not longer than a year. The pollen parent influences the fruit in a number of ways. It is possible, for instance, by selecting the pollen parent to influence the time of ripening, a fact which is now made use of in commerce. Analyses are given of the composition of the fruit of a number of varieties. Harvesting and packing are briefly mentioned. Dates preserved by cold storage absorb moisture at the rate of 1.5% of their weight at 0°C. and 3% at 20°C. Even at the lower temperature fungus attacks are not controlled, a fact which suggests that storage should be done at lower temperatures. Moreover, during storage of Saidy, Halawi, Khadhrawi and Zahidi dates an exterior crystallization known as "sugar spots" occurs and this sometimes amounts to 20% of the weight of the date. This does not occur at -18°C. At such low temperatures no change in flavour occurs, provided the period of storage does not exceed 6 months.

224. LARTER, L. N. H.
The Highgate banana and Panama disease.
J. Jamaica agric. Soc., 1936, 40 : 528-9.

634.771-2.48

The Highgate banana, which has probably arisen as a sport of Gros Michel, possesses some characteristics of a commercial value, being shorter in stature and bearing heavier fruit than the Gros Michel. Planting experiments in conjunction with Gros Michel on infected ground are described. The Highgate banana proved as susceptible as Gros Michel to Panama disease though slightly, but not usefully, slower in developing the symptoms.

225. FOEX, E., AND LANSADE, M.
 Une maladie du bananier. (**A disease of bananas.**)
Rev. Bot. appl., 1936, 16 : 887-92.

634.771-2.48 + 2.3

The bananas affected are an Egyptian variety, Masri, originating in the Canaries, being a horticultural variety of *Musa Cavendishii* Lamb. growing at Beyrouth. The external symptoms are a cessation of growth but no change in the general colour of the foliage, the appearance of small black spots in the neighbourhood of the principal and secondary veins, often slight twisting of the terminal shoot, and malformation of the branch. The roots are not affected. Longitudinal sections of affected plants showed a rotting of the shoot, spreading downwards but not laterally till it reached the collar of the plant. The affected tissues contained a transparent chambered mycelium and some bacteria. These organisms were found in the vessels and parenchyma. Cultures of the mycelium (the technique is described) resulted in its identification as *Fusarium moniliforme* Sheld. *subglutinans* Wr. & Rg. Two varieties of bacteria (4A and 4B) were also isolated, and banana plants (in this case *M. Basjoo* S. & Z. and *M. sapientum* L.) inoculated with these organisms separately and in combination only produced the characteristic symptoms when bacterium 4B was present in the combinations or alone. This bacterium cannot be recognized as belonging to any known species and has, therefore, provisionally been named *B. Maublancii* commemorating a former Professor of the Institut d'Agronomie Coloniale whose work on the

diseases of tropical and sub-tropical plants is well known. A footnote adds that energetic measures taken by the Libyan Government* seem to have since entirely eradicated the disease.

226. STAHEL, G.

634.771-2.42

The banana leaf speckle in Surinam caused by *Chloridium Musae* nov. spec. and another related banana disease.

Trop. Agriculture, Trin., 1937, 14 : 42-5.

This disease, though not so serious as other banana fungal leaf diseases, is capable of greatly reducing the effectiveness of the leaves on which it occurs. A speckle is common in the West Indies and also in Queensland, but conclusive mycological evidence is necessary to decide whether they are identical. A full description of the fungus and its culture is given, and the author proposes the name *Chloridium Musae* nov. sp. The disease is effectively controlled by spraying with bordeaux. A new allied speckle disease closely resembling it but with certain differences which are described, found only on one variety of banana in Paramaribo, has been named *Ramichlodidium Musae* nov. gen. nov. spec.

227. RODRIGO, P. A., AND OTHERS.

635.25 : 581.145.1/2

Preliminary studies on the flowering and seeding of onions in the Philippines.

Philipp. J. Agric., 1936, 7 : 1-19, bibl. 3.

The results are reported of an attempt to obtain viable seed in the Philippines from the big-bulbed (Bermuda) onion and to study the pollination of the flower. Six varieties of big-bulbed onions were grown from imported seed :—Yellow Bermuda and Red Bermuda seeds being obtained from the Canary Islands, Red Globe, Red Brown Bombay and White Bombay from Bombay, Saede and Beheri from Egypt. The onion flowers in the second year after sowing. At the end of the first year such bulbs for flowering are termed mother bulbs. In this experiment a number of the bulbs were "wintered", i.e. stored at a temperature of 10°C. for from 28 to 71 days. This had a decidedly favourable effect, for of the wintered bulbs planted during the onion planting season the percentage of flowering plants (fractions omitted) was Red Globe 82-94, Red Brown Bombay 68-92, White Bombay 71-72, Saede 18-29 and Yellow Bermuda 21, while for the untreated mother bulbs the percentages were Red Globe 45, Red Brown Bombay 26, White Bombay 17 and the remaining varieties did not flower. The flowering of onions under Philippine conditions appears to be a varietal characteristic. Of the varieties which flowered only Red Globe and the two Bombays brought viable seeds to maturity. Failure of some of the others to seed was probably due to a heavy attack of thrips.

228. BECKLEY, V. A.

668.526.2

Essential oils. IV. Oils from exotic plants : geranium oil.

E. Afr. agric. J., 1936, 2 : 287-92.

The identity of the plant producing the true geranium oil is discussed but no definite conclusion is reached. Numerous varieties of *Pelargonium* credited with this attribute are being grown under trial in Kenya. A series of strains have been selected from the *P. radula* group and are here reported on. One or two show promise. Propagation is by cuttings 12 in. long of nearly mature wood with short internodes bearing a few leaves and, if possible, a terminal bud. Cutting for distillation should be done when the leaves turn yellowish, but in a long rainy season, if growth is very heavy, the cut should be made while the branches are still leafy and sappy, otherwise the material will deteriorate with further growth. The oil is contained only in the leaves, but it is cheaper to distill the stems as well than to strip the leaves. The waste from distillation can be composted, provided it is inoculated from a compost or manure heap. The oil has a value of 15s. to 20s. a lb. The yield per acre per annum may be expected to be 20-35 lb. The plant is remarkably free from pests and diseases except for a tendency in the cuttings to damp off in the seed beds, which at the Scott Agricultural Laboratories was controlled by the use of a sand bed.

* Decrets 1226 of 14 Dec., 1934, and 2376 of 19 Oct., 1935, actual measures not stated in this article.

STORAGE.

229. **HARDING, P. L., AND POWELL, C. L.** 644.85.11.037
Transportation of apples from the Shenandoah-Cumberland section to overseas markets.

Tech. Bull. U.S. Dep. Agric., 523, 1936, pp. 26, bibl. 19.

The general objective of the investigation described here was to determine the most satisfactory method of handling and transporting barrelled apples from the Shenandoah-Cumberland section of Virginia, West Virginia, Maryland and Pennsylvania to England. The main studies were made in 1929, 1930 and 1931. Refrigeration during rail transit as compared with ventilation reduced the temperature of the fruit in the top layers of the cars 5° to 16°F. and in the bottom layers 21° to 36°F. Unloading at Jersey City for transfer to ships occupied 6-24 hours, during which time the fruit warmed so rapidly that in some cases 48 to 84 hours refrigeration aboard ship was necessary to recool the fruit to the temperature at which it left the train. When fruit was placed in ordinary stowage on ships the low temperatures derived from rail refrigeration were practically lost within 2-3 days. In ordinary stowage the average daily fruit temperature was about 75°F. and in refrigerated stowage about 42°F. Apples refrigerated both on the train and the ship arrived in England almost free from decay and in the best condition, whereas fruit shipped without refrigeration was usually ripe on arrival and showed various amounts of decay and sometimes of internal breakdown. Refrigeration aboard ship proved particularly beneficial in retarding the rate of softening, and in reducing decay and slackness of pack. Refrigeration during rail transit had no significant effect on the rate of softening but in many cases helped to reduce decay. Fruit refrigerated during rail transit should be stowed, if possible, in separate chambers on the ship to fruit which has not travelled in iced cars, since the latter will raise the temperature of the cooled fruit. Prices for refrigerated summer and early autumn apples as compared with similar fruit shipped in ordinary storage, and particularly during September, indicate that it is economically profitable to refrigerate.

230. **SUTHERLAND, R.** 664.85.11 : 632.19
Factors relating to the control of soft-scald in Jonathan apples.
N.Z. J. Agric., 1936, 53 : 161-6, bibl. 7.

Soft-scald, which usually appears fairly early in the storage life of Jonathan apples or shortly after their removal to atmospheric temperatures, is first seen as a browning of skin and underlying flesh, at first only as mere spotting, later spreading over the whole surface and to varying depths. There is seasonal and local variation in susceptibility, and susceptibility is also increased by storage at low temperatures and by delayed storage. Wrapping the fruit in oiled as against standard wraps and no wraps did not appreciably control the development of soft-scald. Fertilizer treatments were disappointing as a control measure, in fact there is some evidence that they rendered the apples soft, although the yields were much increased. Increased rainfall towards the end of the growing season renders the apples more susceptible to soft-scald. A measure of control can be obtained by picking at maturity (neither under nor over mature), by immediate cooling after picking, and by cold storage at relatively high temperatures (36°F. to 38°F.).

231. **JOHANSSON, E.** 577.16 : 634.11 + 634.13
Bestämningar av c-vitaminhalten hos äpple-och päronsorтер vid Alnarp 1936.
(Determination of vitamin C content in apple and pear varieties at Alnarp (Sweden).)*
Sverig. pomol. Fören. Årsskr., 1936, 37 : 306-18, bibl. 17.

Earlier investigations are briefly reviewed. The vitamin C content for a large number of apples, both Swedish and foreign varieties, is tabulated and the results expressed in milligrams per 100 grams of fruit. The differences between varieties are very marked. Among those showing highest values at harvest and after shorter or longer storage were Blenheim 31.4 mg. per 100 g., Golden Noble 31.2, Pederstrup 30.9, Bramley 27.2, Cornish Gilliflower 27.2, Wellington

* Now reprinted with English summary 1 p. as *Contrib. Swedish Perm. Cttee. Orch. Res.* 43.

26.4, while very low in the scale were Wealthy 5.2, Beauty of Bath 7.4, Lord Suffield 4, McIntosh 3.9. Early varieties were all very low in vitamin C, the best being Beauty of Bath. Cox's Orange from a series of localities varied from 5.1 to 10.7, influenced, it is thought, by environment and storage conditions. Unripe fruits gave lower values than ripe ones. Some fruits maintained vitamin C content in storage better than others, the most suitable temperature for its maintenance being about 4°C. Vitamin C content was very low in fruit stored at room temperature and in shrivelled fruit. Highest values were always obtained from the fruit and even from that part of any one fruit that had been most exposed to light during growth. With pears vitamin C content is smaller, the best results coming from Worden Seckle 12.6 and Seckle 12.3 mg. per 100 g. Triploid do not seem to have a larger vitamin content than diploid varieties, unless the differences in these experiments have been levelled in storage. Å.V.

232. WEBER, ANNA. 664.85.11 : 632.19 + 632.4
Aeblesygdomme under opbevaringen. (Storage diseases of apples.)
 Published by the Faellesudvalget for frugtavløkonomi, Copenhagen, 1936,
 pp. 40.

In this short handbook the physiological disorders and diseases which are known to affect apples in storage in Denmark are dealt with in turn. Illustrations are given in all cases and the symptoms, causes, importance and control are discussed. The subjects dealt with are (1) physiological :—bitter pit, Jonathan spot (3 forms are noted), scald, internal breakdown, frost effects, heart rot, mealy breakdown, watercore, and (2) of fungus origin :—apple scab, brown rot, blue mould (*Penicillium*), *Gloeosporium album*, pink rot (*Tricothecium roseum*), grey mould (*Botrytis cinerea*), and sooty mould. Finally a note is given on damage due to fumigation.

233. BROADFOOT, H. 664.85 : 632.19
Stem end shrivel of Packham's Triumph pear.
Agric. Gaz. N.S.W., 1936, 47 : 635-6.

This is a storage trouble to which this variety is very liable. The stem end shrivels to about half-way up the fruit and the market value is thereby reduced to a greater or less extent. Investigations resulted in the following conclusions. The best stage for packing is when the skin shows a decided yellowish tinge and the fruit gives a pressure test of about 12. The picking stages appear to be the main influencing factor. Oiled wraps exerted no control. Soil conditions or the breaking of the stalks at picking did not influence susceptibility. Late picked fruit was superior in flavour and lost less weight and kept better than fruit picked earlier than the stage indicated. Whereas all varieties of pear in N.S.W. will shrivel if picked and stored when somewhat immature, the degree of shrivelling varies with the sort, Packham's being the most susceptible.

234. ROSE, D. H., AND GORMAN, E. A. 634.75 + 664.85.75.037
Handling, precooling, and transportation of Florida strawberries.
Tech. Bull. U.S. Dep. Agric., 525, 1936, pp. 57, bibl. 15.

In the handling, transportation, and precooling investigations discussed in this bulletin, 36 test carloads of Florida strawberries were used, of which 27 were precooled, 16 with bunker blowers and 10 with pressure-type fans, and 1 with a motor truck apparatus. Both the bunker blowers and the particular truck apparatus used are now practically obsolete. The investigations were conducted in March and April 1931, February, March and May 1932, and March 1935. The results obtained serve as a basis for the following recommendations :—If fruit is warm when loaded (75°F. or above), as much as 5% of salt can safely be used during precooling, provided the precooling period is long enough so that most of the salt will be used up before the car is "pulled". In warm weather, if cars are not precooled and move under standard refrigeration, 4% of salt can safely be used at time of loading, but at the transit re-icings should not exceed 3%. In cool weather, when outside temperatures in transit are likely to go below 32°F., 3% of salt is as much as can safely be used during precooling. If precooling brings the bottom doorway temperature within the range 40° to 45°F., initial icing only will be sufficient for shipments that are likely to pass through freezing temperatures. In icing cars for precooling special care should

be taken. The ice should not be chopped finer than about 50 lb. pieces until within approximately a foot of the hatch bottom. At this point the surface should be piked down level, and fine enough to hold the salt which should then be added. The part of the bunker above the salt should be filled with ice cut into 25 lb. pieces. In the hatchways the ice should be cut into smaller pieces and forced under the bridge and around the sides and ends of the bunker. This fills the voids in the upper section and prevents short circuiting of the air over the top. This method of icing the bunkers provides air channels through the ice and facilitates refrigeration by permitting more air to be drawn through the ice mass, increasing its contact with cooling surfaces, instead of merely moving it over the outside of the bunker screen and cooling largely by contact with the inside of the ice mass. As precooling proceeds, large spaces may be melted out of the ice mass so that, before re-icing, the ice remaining should be thoroughly piked down. Where rapid cooling is desired, the ice supplied should be in large enough chunks so that it will not close air channels, but after cooling has been accomplished it can be chopped finer so as to get more into the bunkers and make it last longer, an important consideration in precooled loads which are to move under initial icing only. If 600 lb. of salt are used during precooling, in the type of cars discussed in this bulletin, it will probably be most effective if added in two different lots, 400 lb. at the beginning and 200 lb. about the middle of the precooling period; if only 400 lb. is used it should all be put in the bunkers at the start of precooling. It is recommended that strawberries when leaving the point of origin should have a temperature of 40°F., or slightly lower, at the top and bottom doorway. [Authors' summary and recommendations.]

235. WARDLAW, C. W., AND LEONARD, E. R. 635.952.2 : 664.85.035.1

Studies in tropical fruits. I. Preliminary observations on some aspects of development, ripening and senescence, with special reference to respiration.

WARDLAW, C. W.

Studies in tropical fruits. II. Observations on internal gas concentrations in fruit.

Ann. Bot., 1936, 50 : 621-53, bibl. 19, and 655-76, bibl. 6; reprinted without change of paging as *Mem. Low Temp. Res. Sta. Trin.*, 4, 1936.

I. Attention has been directed in these preliminary investigations to the shape of the transpiration and respiration curves in developing, ripening, and senescent fruits, to the internal gas concentrations obtaining during these phases, and to the correlation of these processes with the organographic and tissue changes observed throughout the life of the fruit. A brief account of these studies has already appeared in *Trop. Agriculture Trin.*, 1935, 12 : 315-9; *H.A.*, 1936, 6 : 1 : 219 (part II). The authors summarize as follows:—(1) Respiration and transpiration rates have been studied in developing fruits (of tomato, water-melon, papaw, etc.), attention being paid to an evaluation of the operation of the size factor in these processes. (2) By selecting large, hollow, fleshy fruits, e.g. the papaw, it has been possible to determine accurately and by simple means the internal concentrations of carbon dioxide and oxygen throughout development. The relation between such concentrations and the phenomenon of respiration as usually understood is discussed with special reference (i) to the resistance which tissues may offer to the movement of gases, and (ii) to the retentive capacity for CO₂ which tissues at different stages of development may possess. (3) The phenomenon of the climacteric rise in ripening fruits is considered in detail, attention being directed to the internal concentrations of CO₂ and O₂ during that phase. It has been demonstrated that the curve for internal CO₂ concentration (i) begins to rise prior to the onset of the climacteric and (ii) thereafter rises steadily and does not show any modification, comparable with the peak value, observed in "external" respiration studies. (4) The post-climacteric phase, characterized by a decline in the rate of "external" respiration, is marked by a progressive decrease in internal O₂ concentration till finally anaerobic conditions are established. (5) The fundamental part played by O₂ throughout development and ripening would appear to be substantiated by these studies:—(i) The onset of ripening is coincident with the peak value of internal O₂ concentration during development; (ii) the failure of O₂ to gain access to the flesh tissues during the later stages of ripening is thought to be responsible for the phenomenon of senescence in fruits.

II. The investigation described above revealed that certain large tropical fruits are well suited to the investigation of internal concentrations of CO_2 and O_2 . In the present paper an account is given of further investigations made to determine in what manner and to what extent internal gas concentrations are modified under conditions involving the use of controlled external atmospheres, the papaw again being used for the purpose. Such observations are considered to be of importance in relation to the gas-storage of fruit. The results obtained are discussed in relation to the findings of other investigators, and the author summarizes them as follows:—

(1) The experimental procedure adopted indicates the importance of gradients of gaseous concentration in determining the "rate of respiration", i.e. liberation of CO_2 at the surface of the fruit. (2) It is shown that under certain experimental conditions the "rate of respiration" may bear no direct relation to the rate at which cellular respiration is proceeding at that time. (3) On removing a fruit from one gaseous medium to another, readjustment of the several gas concentrations takes place with great rapidity. (4) The amount of CO_2 present in the flesh of fruits is of profound importance in relation to measurements of respiration. (5) It has been demonstrated (i) that the high initial "respiration rates" obtained on removal of fruit from air to nitrogen are purely transitional effects, referable to the amount of CO_2 present in the flesh and cavity, and (ii) that subsequently metabolic processes continue at a rate considerably lower than that observed in air.

PACKING, PROCESSING, FRUIT PRODUCTS.

236. KRONE, B. P. 631.564 : 634.11 + 634.13

Packing apples and pears for export.

J. Dep. Agric. Vict., 1937, 35 : 25-32.

Methods and charts are given for the correct packing of apples in the Canadian standard fruit case and in the Australian dump case. In the former it is essential that the straight method of diagonal packing should be used in conformity with U.S.A., S. African and New Zealand methods. The straight method means that the apples are placed in the case with the stalks all facing in one direction, with the exception of the last apples in each layer which are reversed. In the Australian dump case the diagonal pack is used, but with the apples at an angle. Pears are packed in the $8\frac{1}{2}$ in. standard pear case and in the long bushel case. These packs are also charted and described. The stage of maturity at packing is the important factor in pears. In Williams Bon Chrétien, one of the most exported, correct maturity is indicated by change of ground colour from dark to pale green, change of lenticels from light to dark or corky appearance, a well-filled-out appearance, easy separation from the spur, an immediate rush of juice to the surface when the fruit is sliced. Optimum temperatures are—precooling for 48 hours before packing at $29-31^\circ\text{F}$., a truck temperature before loading of $50-56^\circ\text{F}$., while at loading the core temperature of the pears should be $30-35^\circ\text{F}$. On arrival at the boat the core temperature of the pears should on no account exceed 45°F .

237. ANON. 631.564 : 634.25 + 634.26

Harvesting and packing peaches and nectarines.

Qd. agric. J., 1936, 46 : 675-95.

This is a very complete account of the most suitable methods for Queensland fruit. It contains among much other useful information instructions for making the packing shed equipment and photographs and descriptions of the most useful packs and counts.

238. GREGORY, J. S. 634.771-1.564

Cluster or part-hand packing of bananas.

Qd. agric. J., 1936, 46 : 526-33.

The preference for bananas packed in singles shown by the Australian markets is attributed to the idea commonly held by retailers that more are thereby contained in the case. However,

experiments have shown that this, while true with full-hand packs, does not apply to part-hand or cluster packs. The arguments in favour of cluster packing compared with singles are reduced labour, less risk of damage at the stem end, practically no risk of packing mutilated bananas, delay in incidence of diseases such as black end, stem end rot and squirter which arise through stalk damage, a fresher appearance on ripening after picking. The cluster is defined as containing 3 to 6 bananas and the size of the cluster is not uniform but is arranged to fit the exigencies of the pack, care being taken to have each cluster as numerically large as possible. Several varieties of cluster pack are described and illustrated.

239. HIRST, F., AND ADAM, W. B. 664.85
Varieties of fruits for canning.

Canners' Bull. (Campden), 3, revised 1936,* pp. 45.

Varieties of apples, blackberries, blackcurrants, cherries, damsons, gooseberries, loganberries, pears, plums, raspberries, red currants and strawberries are listed with notes as to their principal fruit characteristics and their suitability or otherwise for canning. The general qualities desirable in the different fruits and the defects from which they most commonly suffer are also noted. In an appendix tables are given showing the relationship between diameter and weight of fruits and approximate normal distribution of sizes for gooseberries (Careless), cherries (two groups), plums (Victoria, Pershore and Purple Pershore) and damsons (Shropshire Prune).

240. ASKEW, H. W. 663.3 : 581.192
pH values and titratable acidity of apple-juices.
N.Z. J. Sci. Tech., 1936, 18 : 131-6.

It is shown that the titration curves of apple juices are of the same form as those of solutions containing malic acid. The pH values of malic acid solutions and of apple juices containing added malic acid tend towards a constant pH value with increase in acidity. The pH values of apple juices lie on a curve of the same form as that for malic acid solutions, but the presence of the buffering substances in the juices increases the pH values above those of the malic acid solutions, where corresponding titratable acidities are compared. It is concluded that determination of the pH value alone does not give a sufficiently clear picture of the acidity status of apple juices owing to the relatively small change in pH value resulting from large changes in the titratable acidity at the higher figure. [Author's summary.]

241. WIEGAND, E. H., AND OTHERS. 632.952.1 : 664.85.22
Effect of sulfur sprays on corrosion of prune cans.
Sta. Bull. Ore. agric. Exp. Sta., 345, 1936, pp. 42, bibl. 6.

Prunes sprayed with dritomic wettable sulphur, koloform wettable sulphur, kolodust, super poppy dust, lime-sulphur and bordeaux mixture were washed or left unwashed and were canned in 30° Balling syrup and hot water in cans made of two general grades of tin plate, namely coke and charcoal, either plain, enamelled or re-enamelled in each case. The cans were stored at air temperatures of 70°-72°F., and were subjected to physical examinations and chemical analyses at intervals up to 800 days in order to determine to what extent sulphur spray residues might be responsible for corrosion of the cans. The amount of sulphur found in the cans was in all cases less than 0.3 p.p.m. of the can contents, and corrosion occurring in the sprayed lots was extremely similar to that observed in unsprayed control packs. Corrosion caused by the minute amount of sulphur was confined principally to enamelled coke-plate cans and was generally more marked with unwashed than with washed fruit. The charcoal plate proved in all cases to be superior to the coke plate, indicating the value of using a better grade of plate. The enamelled coke plates were in general associated with more rapid spoilage than the plain coke plates, a fact which is attributed to intensively localized action on the tin and iron of the can, where defects occurred in the enamel coating. The results would also appear to indicate that syrup packs corrode more rapidly than do water packs. A second series of experiments was made with

* First issued 1931.

compounds added direct to cans to determine the effect of increased quantities of sulphur. Sodium thiosulphate, sodium sulphide and elemental sulphur added at a rate of 10 p.p.m. to the cans proved to be very active in producing corrosion, an effect which was due, it is thought, to the relatively large quantities added compared to the amounts introduced through spraying. The effect of sodium sulphite at 10 p.p.m. was less severe, the charcoal plate and enamelled coke plate cans comparing favourably with the controls up to the end of the experiment, and only the plain coke cans being markedly affected. This is held to have been due to the fact that sodium sulphite is readily oxidized to the sulphate form, in which condition there is no active reaction. The general conclusion reached is that the spray materials tested, when properly applied, do not introduce into the cans sufficient residue to be a factor in causing corrosion.

242. BRUCKNER, V., AND SZENT-GYÖRGYI, A. 663.815.2/7 : 581.192
Chemical nature of citrin.

Nature, Lond., 1936, 138 : 1057.

"Citrin" was the term applied to a substance, differing from other known flavones, which was isolated from lemon juice. It has since been shown to consist of mixed crystals of two different dyes, one, hesperidine (m.p. 261°), forming the major part, and the other being an eriodictyol glucoside. It seems probable that the latter is formed from hesperidine by demethylation on ripening of the fruit.

243. NÈGRE, E. 634.8 : 663.813
 Procédés de préparation et de conservation des jus de raisin. (**Methods of preparing and preserving grape juice.**)
Progr. agric. vitic., 1936, 106 : 162-5, 187-8, 209-14, 236-8 and 258-60.

There are many processes by which non-alcoholic grape juice may be prepared and preserved, but not all are equally satisfactory. The object of any process should be to preserve the liquid in its original state of freshness, to maintain its nutritional value and to prevent it acquiring unpleasant flavours. As a general rule processes involving the use of antiseptics should not be used, either because these are slightly toxic, or because they impart undesirable flavours. The methods which may be used are discussed in detail under the following headings:—A. Preliminary operations. These include harvesting, pressing, draining and clarification by means of sulphur anhydride, low temperature, precipitation through the action of substances such as gelatin and tannin, or by means of enzymes. B. Methods of preservation, which include pasteurization, Matzka's process, Katadyne's process, concentration, ultra-violet rays, sterilizing filtration, and the use of carbon dioxide gas. The need for avoiding contact with certain metals in containers, etc., is stressed. Finally some practical aspects of the grape juice industry and its future are discussed.

244. NÈGRE, E. 663.813 : 581.192
 Le jus de raisin. (**The chemical composition of grape juice.**)
Progr. agric. vitic., 1936, 106 : 321-4, 350-2 and 372-6.

The chemical composition of non-fermented grape juice is tabulated and discussed in relation to its nutritive and therapeutic qualities. The juice contains 700-800 g. water, 100-250 g. sugars and 50-60 g. other substances per litre. The sugar content consists mainly of the reducing sugars, glucose and levulose, and its proportion varies according to variety, locality and the stage of maturity of the fruit at the time of harvesting. In some cases it may reach 30%. The calorific value of grape juice lies between 600 and 900 calories per kg., which is a higher value than that of milk, wine, or the juices of apples, pears, and cherries. Organic acids are present only to an extent of 3 to 12 g. per litre, while the quantities of inorganic acids are even smaller, though varying considerably with the soil on which the vines are raised. In fruit grown on soils containing high sodium chloride, for example, the hydrochloric acid content may rise from 0.03-0.15 to 2.5 g. per litre, and similarly where calcium sulphate is high in the soil the sulphuric acid content of the juice may exceed 0.70 g. per litre as compared with a normal content of 0.16-0.33 g. Potassium is present in amounts of 0.75 to 2.0 g. per litre, calcium 0.10 to 0.20,

magnesium 0.10 to 0.18, and oxides of iron and manganese in much smaller amounts. Nitrogenous substances occur in the proportion of 0.35 to 0.80 g. per litre, and of these amounts 0.06 to 0.15 g. are present in forms of ammonia-nitrogen. Grape juice contains both pectic and tannoid substances, the amounts of which increase as the fruit becomes ripe. Studies by other workers have shown that vitamins A, B, B₁, C and P are present, C in particular being plentiful. Finally the considerable value of grape juice as a constituent in human diet is discussed.

245. PEDERSON, C. S., AND TRESSLER, D. K. 663.813
Improvements in the manufacture and the preservation of grape juice.
Bull. N.Y. St. agric. Exp. Sta., 876, 1936, pp. 29, bibl. in text.

A study was started 6 years ago of the factors involved in the deterioration of bottled, unfermented grape juice made from fruit of the variety Concord. The present paper is a general discussion of the results obtained and their application to methods of processing. Particular attention is paid to methods of preservation by pasteurization, but cool temperature storage, freezing storage, germ-proof filtration, storage under CO₂ pressure, concentration of the juice, and the use of chemical preservatives are also briefly discussed. The three essential processes involved in the preparation of grape juice are described separately. (1) Pressing, pasteurization and bottling. Methods of hot and cold pressing grapes to extract the juice are outlined, the former being the more commonly used in the preparation of unfermented juice. Until recently temperatures of 190°-195°F. have been used for pasteurization in commercial plants while in some cases the juice has even been boiled. Such high temperatures are detrimental to the product, resulting in cooked flavours, and have been shown to be unnecessary. Pasteurization both for carboy storage and for bottling may be carried out effectively at 165°-170°F., when the containers are filled to the top and the juice constantly stirred, care being taken to remove the foam and suspended solids and to sterilize the corks as well as the containers. The action of micro-organisms, the effect of enzymes and of air are considered to be the main causes of deterioration in grape juice. The first two of these may be overcome by proper pasteurization and handling. Harmful effects due to air may be reduced considerably by eliminating air from the bottles by filling them to the brim at temperatures slightly above those used for pasteurization. (2) Storage of juice to allow crystallization of argols or the crude tartrates and sedimentation of the solids. Particular attention is paid to rapid methods such as the use of "Pectinol" clarification and freezing and thawing procedures. (3) Rebottling and repasteurization and the storage of the finished product are described. Finally, the carbonation of grape juice is discussed, and a brief description is given of a method of carbonating by the use of dry ice.

246. BODENSTEIN, J. C. 634.774 : 581.192
The composition of pineapples.
Sci. Bull. Dep. Agric. S. Afr., 153, 1936, pp. 14, bibl. 20.

Very little has been known hitherto with regard to the composition of pineapple fruits, and this lack of data has been most apparent when analysts have been called upon to examine synthetic or partly synthetic products used to imitate pineapple flavour in so-called fruit-drinks. The present investigation was undertaken mainly on this account. Four bulk samples consisting of 20, 24, 11 and 19 fruits of the Queen type were obtained from the Johannesburg market during the period September to March 1933-4. In examining methods of obtaining samples of clear juice, cutting the fruit into slices about $\frac{1}{2}$ inch thick and pressing each slice separately in a powerful screw press proved to be a much better method than squeezing and filtering after the fruit had been finely cut up. Results of analyses are given in a series of tables together with standard deviations and coefficients of variation. Minimum and maximum figures obtained for the four samples are given as follows:—Alcohol-insoluble residue per 100 grams 3.00 to 3.32 grams, and expressed in grams per 100 millilitres, soluble solids 16.24 to 18.93, sucrose-10.80 to 12.89, reducing sugar 2.73 to 3.13, glucose 1.55 to 1.82, fructose 1.15 to 1.32, citric acid 1.01 to 1.05, nitrogen 0.038 to 0.046, and ash 0.360 to 0.448. With regard to reducing sugar it was noted that Davies had concluded that the proportion in the juice represents 20%-40% of the

total sugar following heat sterilization, whereas the figures given above represent a range of only 18·6% to 21·9% obtained prior to sterilization. An investigation was therefore made to determine whether inversion occurs during the process of heating. Six samples, which before sterilizing contained proportions of reducing sugar lying between 13·3% and 24·4% of the total sugar, were heated and again analysed. The proportions of reducing sugar after sterilization were found to have risen to 29·5%-49·0% of the total sugar, indicating that a very considerable amount of inversion had taken place. The composition of the ash was also determined and the figures obtained, expressed as percentages, were :—Potash 49·3 to 56·0, lime 2·93 to 4·02, magnesia 7·2 to 8·5, and phosphoric oxide 1·91 to 2·41. A definite negative correlation was found to exist between potash and lime contents. Finally the manganese content of the ash was determined, and was found to show marked variation both between samples and between individual fruits. In the four samples the milligrams of manganese oxide per 100 ml. ranged from 0·68 to 1·65.

247. MARCELET, H. 665.327.3
Présence d'hydrocarbures saturés et non saturés dans l'huile d'olive. (**The presence of saturated and unsaturated hydrocarbons in olive oil.**)
C. R. Acad. Agric. Fr., 1936, 22 : 447-9.

The oily residue removed in the deodorization of raw olive oil was analysed to determine the presence of substances which cannot be isolated directly from the oil on account of their dilute state. Analyses were based on about 5 kg. of the residue, representing 5 (metric) tons of oil. 7·6% of the residue consisted of unsaponifiable matter, and the properties of this aromatic liquid indicate that it should be classed among the hydrocarbons. Separation was accomplished by fractional distillation in a vacuum into four groups, in the last two of which the deposition of crystals occurred at laboratory temperatures. Subsequently six unsaturated liquid hydrocarbons and two saturated solid hydrocarbons were isolated and the major properties of these are tabulated. The flavour of the liquid products is acid and bitter. These hydrocarbons only represent about 0·07 g. per kg. of raw olive oil, which explains why their presence has hitherto escaped notice.

248. TISSOT, P. 633.912-1.57
Utilisation de l'huile et des tourteaux de l'Hévéa. (**Hevea seed oil and oil cake.**)
Rev. Bot. appl., 1936, 16 : 138-41, bibl. 5.

Hevea seed which is often available in considerable quantity produces, when properly expressed, at least 50% of oil cake and 44% of oil. The latter is used in various manufactures, often as a substitute for linseed oil. The cake is a useful organic manure applied at the rate of 1,500-2,000 kg. per hectare every three years; to make a complete fertilizer, 200 kg. of calcium phosphate and 200 kg. of wood ash should be mixed with it. Also as feed for cattle or pigs it is at least as nutritious as linseed cake and is neither heating nor laxative. Cases of poisoning, however, have occurred, owing to the presence of hydrocyanic acid. The author attributes this to faulty preparation, in particular cold expression.

NOTES ON REPORTS.

249. MINISTRY OF AGRICULTURE, LOND. 634.7 + 634.37 + 635.61
Fruit Production : soft fruits. 3rd edition.
Bull. Minist. Agric. Lond., 4, 1936, pp. 71, 1s. 6d.

This supersedes the 2nd edition published in 1934 (*H.A.*, 1934, 4 : 3 : 499). Several of the sections have been considerably revised particularly as regards varieties recommended. The

fruits dealt with are:—strawberries, gooseberries, currants, loganberries with diagrams of appropriate training methods, raspberries, blackberries and various other *Rubus* species, figs both under glass and in the open, and finally melons in hothouse and frame. Accepted and approved methods of cultivation are described in all cases and particular varieties are recommended. The chief pests and diseases likely to be encountered and the best methods of control are also given in most cases. Finally in this edition a brief note is added (1 p.) on the pollination of soft fruits and on their insect visitors.

250. NEW ZEALAND.

634/5

Tenth Annual Report Department of Scientific and Industrial Research, 1935-6, 1936, pp. 107.

Only the work of the Department which concerns horticultural crops is abstracted here. In fruit research the superiority of complete fertilizer dressings has been demonstrated on Sturmer apples. Results have shown a 77% increase over the unmanured plot, while plots receiving phosphate and nitrogen in combination have shown significant crop increases. Trees receiving nitrate alone are intermediate, while those receiving phosphate alone are deteriorating. On Sturmer and Jonathan colouring was not affected by heavy potash dressings, but size appeared to be increased. In iron, manganese and hydrated lime tests on Jonathans all trees receiving manganese developed severe bark canker affecting all wood up to the current season's growth. In cold storage trials fruit from 2 lb. and 4 lb. per tree ammonium sulphate plots of Jonathans have given progressive increases in breakdown compared with no application, but in 1934, a heavy crop season, there was a complete absence of breakdown in all three treatments. Nitrogen treatment and also heavy potash treatment resulted, probably indirectly, in a considerable increase in scald under low temperature conditions. With Sturmers nitrogen alone has tended to increase breakdown susceptibility on long storage. A progress report is also presented of manurial trials conducted by the Cawthron Institute on apples in several districts, the oldest trial having been running for 15 years, and also of a number of co-operative trials on various fruits on commercial orchards, 75 being now in progress. With Cox's a comparison of 3 commercial grades produced very significant evidence on the association of breakdown and water core in this variety. Stock trials in their third year show with one exception East Malling stocks to be superior in vigour to Northern Spy. Trees of a number of apple varieties are also being raised on their own roots for comparison with these stocks. Root wounding experiments laid down in 1932 to test the possibility of mechanical injury to roots of trees on Spy resulting in increased vigour of the trees failed to produce the desired development in fibrous root arising from the treatment, or in fact any benefit. A partial survey has been made of the boron status of orchard soils, and treatment with borax by various methods has in each case proved beneficial. Soil examinations have shown that top dressings of borax have penetrated 18 inches into the soil during the course of the growing season. Notes of data on various points obtained from a series of transport and storage trials are given.

251. LANGE OSSEKAMPEN.

634.1/2-1.8

Jaarverslag van de werkzaamheden in het jaar 1935 verricht op het centrale Bemestingsproefveld voor de fruitteelt "de Lange Ossekampen" 1935.

(Annual work report of the fruit tree manurial experiment station Lange Ossekampen, Wageningen, Holland, for 1935.) 1936, pp. 30.

This is the first report of a new fruit tree manurial experiment station which has been recently opened at Lange Ossekampen in Holland through the generosity of the N.V. Amsterdamsche Superfosfaatfabriek and under the guidance of the Director of the Tuinbouwplantenteelt Laboratoria at Wageningen who will have complete freedom in the choice of manures and in the conduct of experiments. Part of the ground contains a 20-year-old apple and cherry orchard and part has never yet carried fruit. The report gives a description of the terrain and buildings, an account of the laying down of the first experiments and the results of soil examinations undertaken in 1934 and '35.

252. I.N.E.A.C.* 581.084.1
Rapport annuel pour l'exercice 1935. (Annual report on experimental work in 1935.)
Bull. agric. Congo belge., 1936, 27 : 379-441.

This is the second annual report of the Institute, which is concerned mainly with agricultural research in the Belgian Congo, under Government auspices. Since the work of the Institute is only in its beginnings results of experiments are not yet available. There are, however, lists of the experiments already laid down for a large number of crops including oil palm, coffee, *Hevea* and cacao. They are spread over a number of experimental plantations throughout the Colony. Some of these plantations were already in existence when the Institute assumed control, others have been newly formed. The report is an indication of the very active revival of scientific agricultural research now taking place in the Belgian Congo.

253. AZIENDA AGRARIA RAVENNA.† 634.1/2
Rivista di frutticoltura, 1937, Vol. I, No. 1, pp. 47. 8 liras a number, 30 liras a volume (subscriptions to conto corrente postale 8/10608) Riv. Frutt. Ravenna, Italy.

Italian fruitgrowing reaches its peak in Emilia where some 25,000 acres are devoted to intensive fruit culture, peaches accounting for more than half the area, the rest being under plums, apples, cherries and pears in descending amounts. One of the chief factors in its success has been the devoted and intelligent work of the horticultural officers of the Provincial Inspectorate of Agriculture at Ravenna. For some time the need has been felt for a properly edited and scientifically controlled journal in which the results of practical and exact experiments in the area might be clearly set out and at the same time news given of work in other parts of the world. The first number makes a good start with an account of peach root growth and its bearing on the best time to plant (see abstr. 28). The paper and print are good, the illustrations clear and well reproduced. Eight pages are devoted to abstracts of foreign and Italian papers. There are certain printer's errors, which to a foreigner might be momentarily disconcerting. Moreover, the binding cotton which holds the pages in place soon ceased to function in the reviewer's copy and is unlikely to be stronger in others, but these are slight flaws which could easily be avoided in future numbers. If the original article is a fair sample, the success of the journal should be assured.

254. HORTICULTURAL EDUCATION ASSOCIATION. 634/5
Scientific Horticulture, 1937, Vol. 5, pp. 196, 3s. 6d., plus postage 5d., Editor, S.E. Agric. Coll., Wye, Kent.

The editor of *Scientific Horticulture* presents again his mixture of narrative, practice and science and includes a varied choice of articles, most of which are of far more than local interest. As narrative might be described the articles on commercial horticulture in Essex and Middlesex, on fruit growing in North Wales, and on the pot plant industry. Articles of immediate practical value deal with vegetable manurial experiments in Lancashire, timber for glasshouse construction, peat in horticulture, horticultural soil problems, the routine management of lawns, and the sudden death of fruit trees and bushes due to waterlogging. In two articles for potato growers the virus problem and that of aphid migration and distribution as affecting seed potato production are discussed. Articles from the horticultural scientist include :—Recent American work on the copper fungicides, the effect of maturity of apples on keeping quality, and the results of recent Dutch investigations into the temperature requirements of hyacinths. Finally two articles deal with problems which very closely affect horticulture and may be considered as fundamentally affecting its practice, namely bud dormancy and plant hormones. Abstracts of the more important papers will appear in *H.A.*, 7 : 2.

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